# AN OVERVIEW OF THE CANADIAN COMPUTER SERVICES INDUSTRY

by

B.F. Hough

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OTTAWA, CANADA SEPTEMBER 1981

## RESUME

Cet exposé présente un aperçu de l'industrie des services de l'informatique au Canada. Il décrit les éléments de coût et de technologie affectant le taux d'accroissement et identifie les sources de rentes. La direction du traitement des données et les sources periphériques sont repassées et l'impact d'une pénurie de programmateur est discuté. La tendance des fusionnements de sociétés et la rationalization de l'industrie de l'informatique sont alors décrites en bref. La communication termine sur le point que la spécialization est essentielle à la survivance.



## ABSTRACT

This paper provides an overview of the computer services industry in Canada. It describes the cost and technology factors affecting the rate of growth and identifies the various revenue sources. Processing trends and software sources are reviewed and the impact of a shortage of programmers is discussed. The pattern of company mergers and information industry rationalization is then briefly described. The concluding point is that specialization is the key to survival.

## ACKNOWLEDGEMENTS

While the author accepts full responsibility for the contents of this paper, the help of many business and government executives is gratefully acknowledged. Those that assisted by participating in lengthy interviews include:

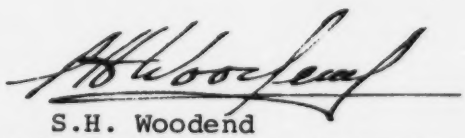
| | | |
|---|---|---|
| Don Stewart | President | Maritime Computers Ltd. |
| Robert Mutch | Sales Manager | Maritime Computers Ltd. |
| Peter White | Manager of Atlantic Canada | Computel Systems Ltd. |
| Douglas McCann | Technical Consultant Atlantic Canada | Computel Systems Ltd. |
| Jim Muir | Communications Consultant | The Computer Communications Group, Maritime Tel & Tel |
| Stephen F. Dow | Branch Manager | Digital Equipment of Canada Ltd. |
| Gorden Brown | Vice President | Mandala Systems Ltd. |
| Mike Summerfield | Regional Manager Atlantic Canada | Reynolds & Reynolds Canada Ltd. |
| Dave Reader | Technical Specialist | Reynolds & Reynolds Canada Ltd. |
| Peter McCauley | President | Micronet |
| Shelley Wilcox | General Manager | Micronet |
| Nicholas Jupp | Sales Manager, Basic Four Computers | MAI Canada Ltd. |
| Peter Mason | President | Dymaxion Research Ltd. |
| Sieg Deleu | President | Kobeteck Systems Ltd. |
| Gary Bryson | Regional Manager, Atlantic Canada | Systemshouse Ltd. |

| | | |
|---|---|---|
| Tom Conrad | Systems Analyst | Systemshouse Ltd. |
| Steven Hatt | Field Service Rep. Atlantic Canada | Norand Canada Ltd. |
| Randy Barkhouse | Assistant Director Teaching/Consulting | Dalhousie University Computer Centre |
| Wayne Champniss | Manager | Nova Scotia Government Data Centre |
| Paul Dober | Economist, Statistical Service Branch | Nova Scotia Department of Development |

## FOREWORD

This paper was written by Maj B. Hough, now of the Directorate of Logistics Analysis, while he was attending Dalhousie University in 1979-81 for post-graduate studies under the sponsorship of the Operational Research and Analysis Establishment of the Department of National Defence.

The work was carried out in partial fulfillment of the requirements for the Master of Business Administration (MBA) degree program at Dalhousie. However, the subject is of considerable current interest and, therefore, the paper is being published as an ORAE Memorandum.



S.H. Woodend
Director General General Analysis
for Chief
Operational Research and
Analysis Establishment

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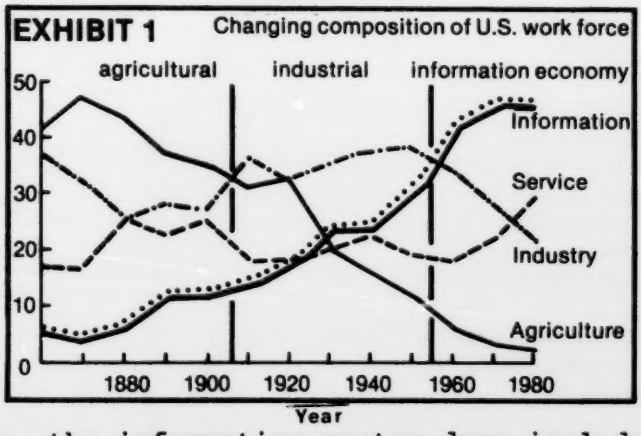
I. Introduction - Exponential Growth, Turmoil

The computer industry, perhaps more than any other, tests a manager's ability to cope with change. As stated by D.J. Doyle, President of Digital Equipment of Canada, "the rate of change in the environment is increasing and the major challenge to any business manager operating in this industry today is to manage these changes."[1]

Some authors have analysed this turmoil in the context of a third economic revolution - stating that the economy created by the industrial revolution is being superseded by one based on the generation, collection, transmission, processing and use of information.[2] This transformation is illustrated in Exhibit #1 below:



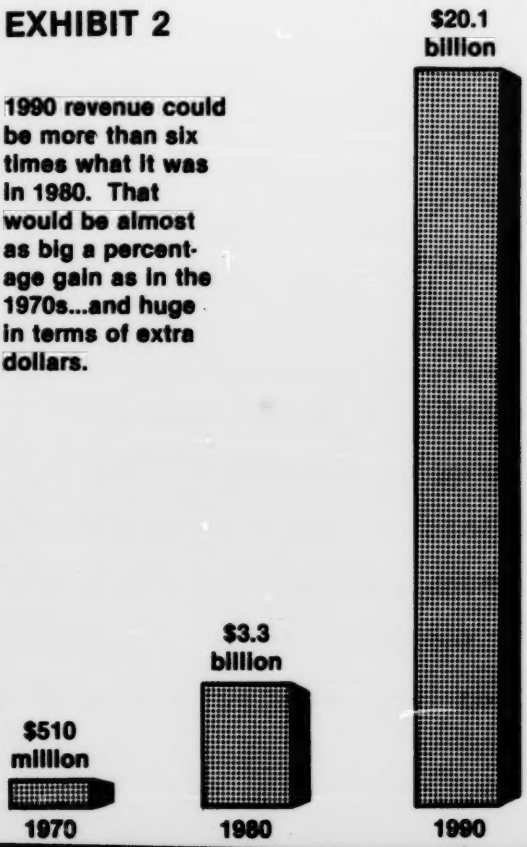

Admittedly, the information sector does include some manufacturing in, for example, the computer and telecommunications industries. By definition, the information sector comprises a primary sector (which includes all of the activities listed above) as well as a secondary sector (information services produced and consumed internally by industries and government.)

The service segment of the computer industry faces more turmoil than the hardware segment. It must adapt to changes in hardware, marketing methods, distribution channels, processing methods, applications, user profiles, and programmer availability to mention just a few variables. Furthermore it must accommodate these changes while growing exponentially. During the 1970s Canada's computer services industry experienced an annual average growth rate of 22%.[3] A growth rate of 25 to 35% per year is expected during the 1980s.[4]

The growth in revenue of the total computer industry (hardware, processing and software) is forecast in Exhibit #2 below:[5]

**EXHIBIT 2**

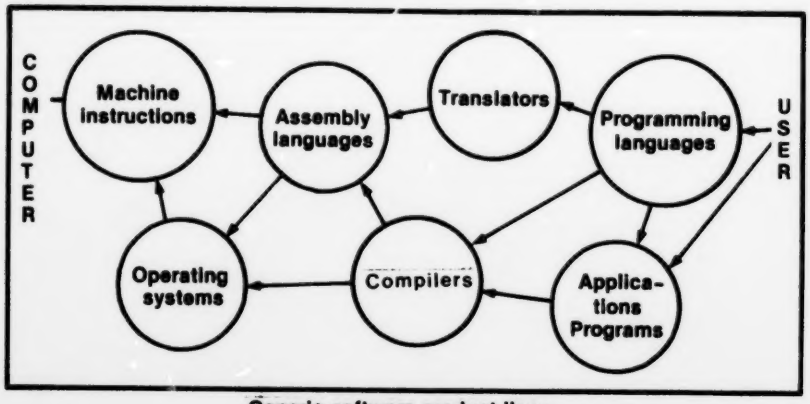
**1980 revenue could be more than six times what it was in 1980. That would be almost as big a percentage gain as in the 1970s...and huge in terms of extra dollars.**



II. Hardware - Number of Computer Installations Increase

The demand for computer services would be classified by economists as "derived demand". The need for software is initially created by the purchase of a computer, as shown in the following diagram:

**EXHIBIT 3**




Generic software product lines.

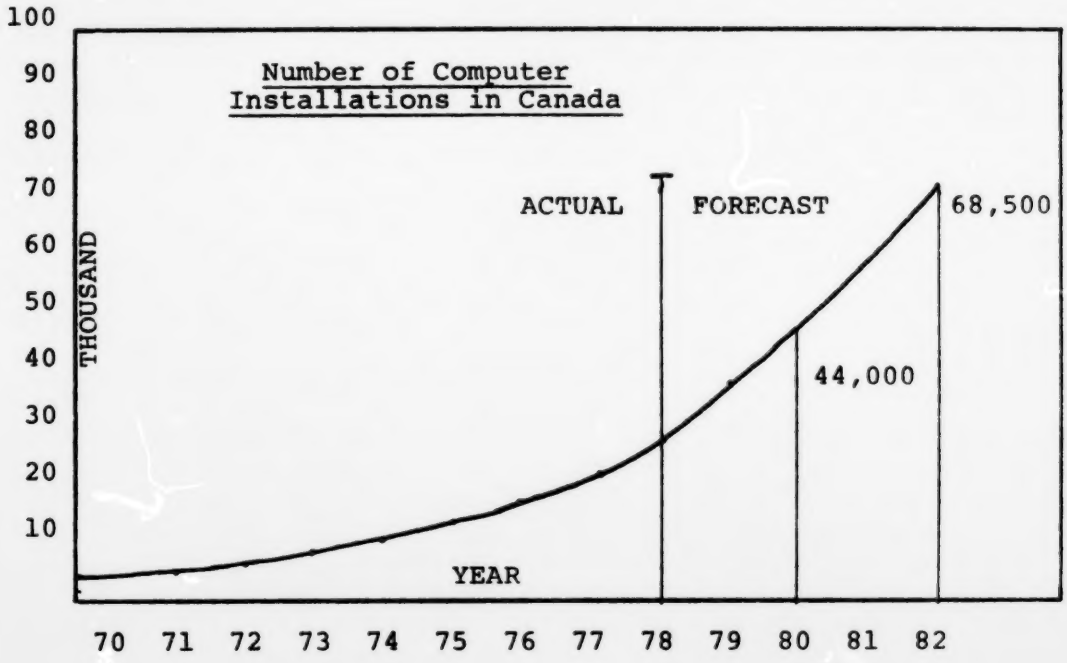
However, once the computer is in place, the need for software continues growing as more and more applications become apparent.

Thus, it is worthwhile to know how many computer installations there are in Canada and how rapidly this figure is increasing. This information is given in Exhibit #4. (See page 4).

It is also important for the service sector to be aware of changes in market share amongst major hardware manufacturers. The main reason for this is that software developed for use on one manufacturer's equipment may not work on equipment made by other firms. Also, to the extent that affiliations exist between service and hardware firms, it would be best

to be affiliated with a hardware firm that is increasing market share.

Exhibit #4




The figures in Exhibit #5 show quite clearly the increasing market share of the smaller computer firms (such as MAI and Hewlett-Packard) and the declining share of the big firms, especially IBM.[7] Also evident is strong competition amongst the top twelve firms. Note that ten firms are among the leading suppliers in terms of both computers sold and installed value, and that twelve firms in each section accounted for 82% of the numbers of computers and 92% of the installed value recorded in the 1979 census.

Exhibit #5

MARKET SHARES OF LEADING COMPUTER MANUFACTURERS
CANADIAN MARKET - 1979 CENSUS

A. BY % OF TOTAL COMPUTERS SOLD

| MANUFACTURER | YEAR: | 1976 | 1977 | 1978 | 1979 | |
|---|---|---|---|---|---|---|
| . IBM | | 27.7 | 25.0 | 22.3 | 23.2 | ↓ |
| DEC | | 16.6 | 19.1 | 17.7 | 17.9 | |
| . HON-CGE | | 9.0 | 7.7 | 7.1 | 6.9 | ↓ |
| NCR | | 7.5 | 7.4 | 9.1 | 6.9 | |
| UNIVAC-VARIAN | | 6.8 | 6.5 | 5.8 | 6.0 | |
| . HEWLETT-PACKARD | | 3.7 | 4.4 | 5.2 | 5.7 | ↑ |
| DATA-GENERAL | | 3.0 | 4.0 | 3.6 | 4.4 | ↑ |
| BURROUGHS | | 2.9 | 3.5 | 3.6 | 3.1 | |
| . MAI | | 2.2 | - | 2.1 | 2.8 | ↑ |
| 4-PHASE | | - | - | - | 1.8 | ↑ |
| DATA 100 | | - | - | - | 1.8 | ↑ |
| . PERKIN-ELMER | | - | - | - | 1.7 | ↑ |
| OTHERS | | 20.6 | 22.4 | 23.5 | 17.8 | |
| | | 100.0 | 100.0 | 100.0 | 100.0% | |

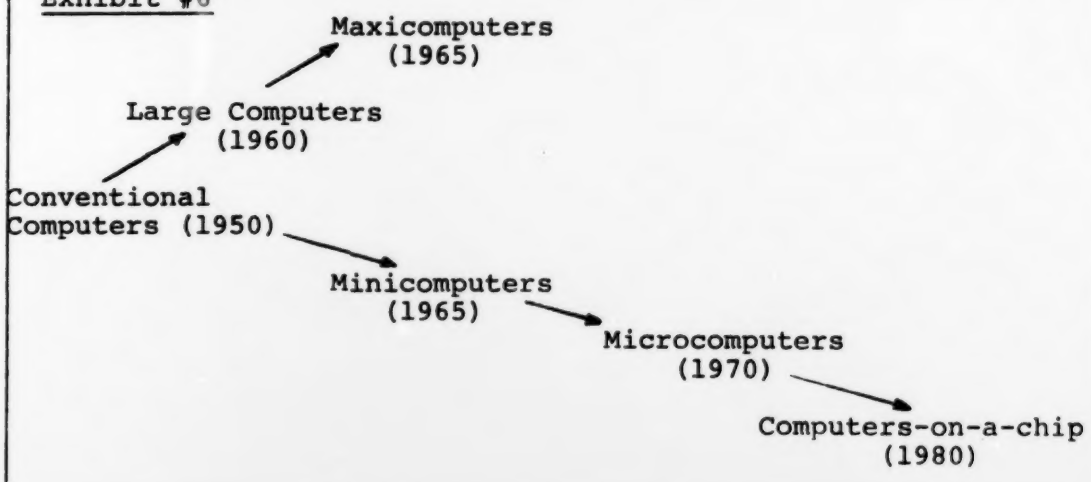
B. BY % OF ANNUAL RENTAL VALUE

| MANUFACTURER | YEAR: | 1976 | 1977 | 1978 | 1979 | |
|---|---|---|---|---|---|---|
| . IBM | | 55.3 | 53.8 | 50.7 | 48.4 | ↓ |
| DEC | | 6.0 | 7.3 | 7.8 | 9.3 | ↑ |
| UNIVAC-VARIAN | | 9.5 | 8.9 | 8.5 | 8.8 | |
| . HON-CGE | | 9.0 | 8.5 | 8.6 | 7.9 | ↓ |
| AMDAHL | | - | - | 0.7 | 3.1 | ↑ |
| BURROUGHS | | 3.1 | 3.1 | 3.3 | 3.0 | |
| NCR | | 2.7 | 2.7 | 3.3 | 2.7 | |
| . HEWLETT-PACKARD | | 1.2 | 1.8 | 2.3 | 2.7 | ↑ |
| CDC | | 3.6 | 3.3 | 3.1 | 2.7 | ↓ |
| DATA GENERAL | | 0.8 | 1.2 | 1.2 | 1.6 | ↑ |
| . MAI | | 0.5 | - | 0.5 | 0.7 | ↑ |
| . PERKIN-ELMER | | - | - | - | 0.6 | ↑ |
| OTHERS | | 8.3 | 9.4 | 10.0 | 8.5 | |
| | | 100.0 | 100.0 | 100.0 | 100.0% | |

The main reason that IBM, GE, UNIVAC, and BURROUGHS are experiencing slow growth in Canada is that they failed to take advantage of the trend toward smaller computers (which is linked to the trends toward increased use of

communication networks, more distributed processing, and escalating small business applications). This trend is documented in Exhibit #8. The successive generations of computers (by size) are indicated below:

Exhibit #6

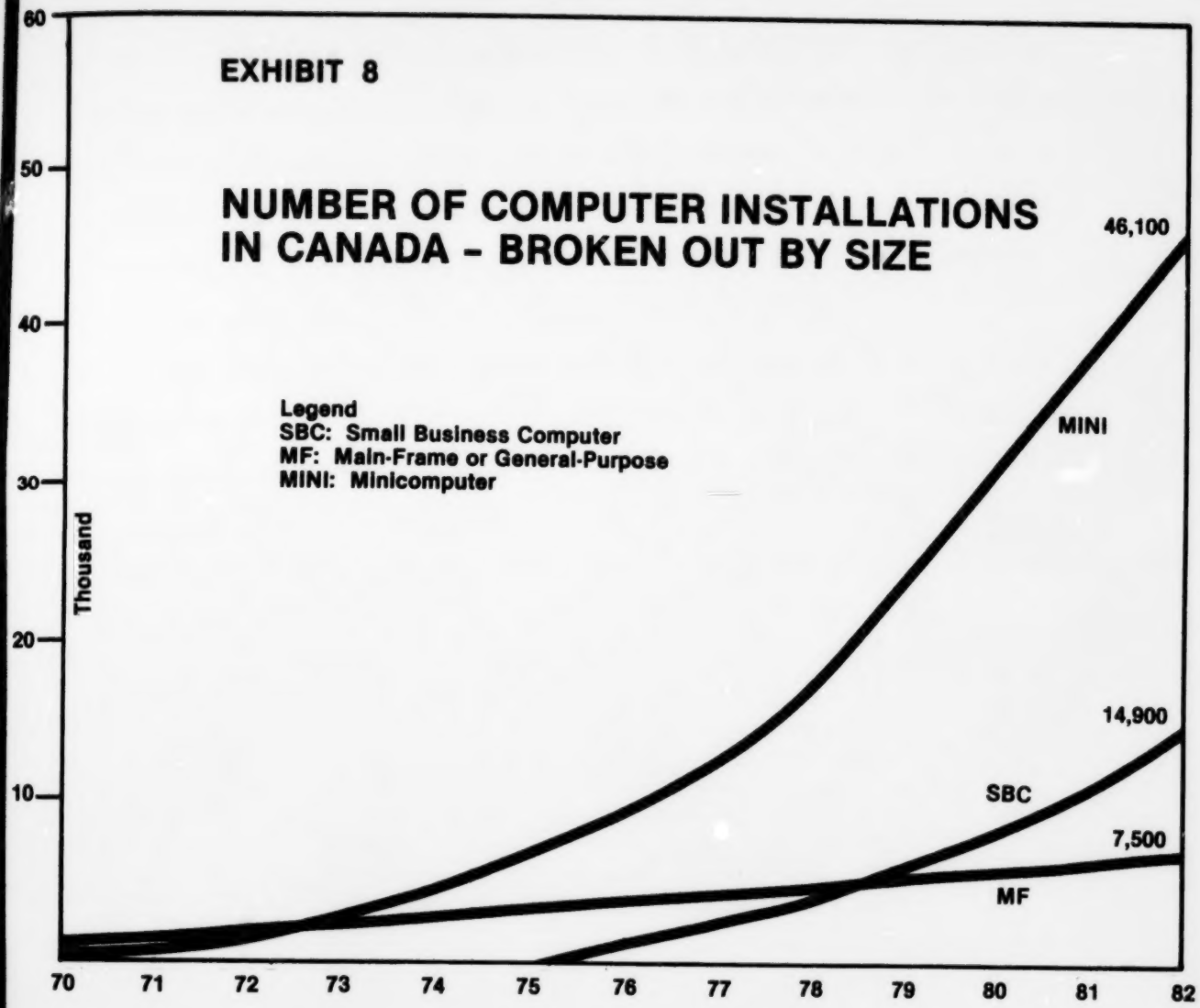



The minicomputers now dominate the Canadian market. Microcomputers will be a major factor in the 1980s. Note the following trends:[8]

Exhibit #7

| Computer Size | Average Annual Growth | |
|---|---|---|
| | 1975 | 1980 |
| Main Frame | 12% | 13% |
| Mini | 29% | 29% |
| Small Business Computer | 112% * | 42% |

* (Small Business Computer Introduction)

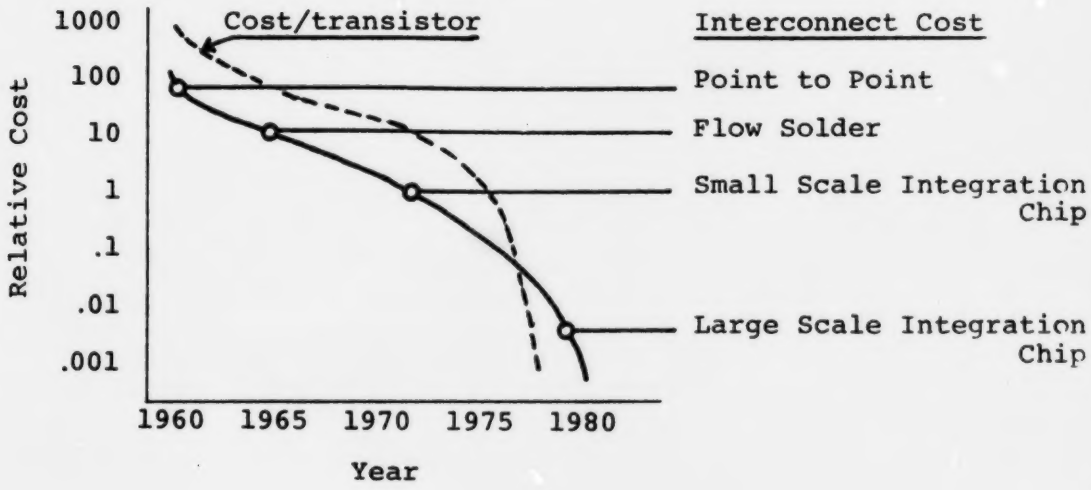



Hardware Costs Decline

The driving force behind the growth in the computer industry is the rapidly decreasing cost of hardware and the associated increase in applications. Hardware prices have dropped by a factor of 1,000 since 1955,[9] and are presently

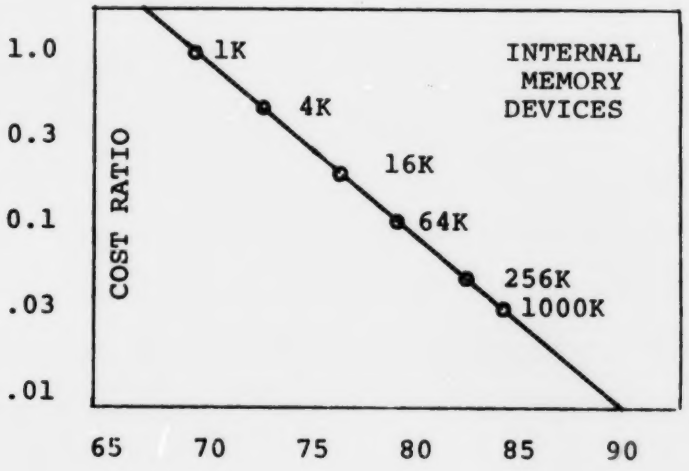
falling at the rate of 30% per year.[10] The greatest gains have been made in silicon chip arithmetic and logic circuits and in computer memory technology. For example, Exhibit #9 shows the decline in cost of silicon chips. Exhibit #10 shows how internal memory capacity will continue to increase while its cost rapidly decreases:[11]

Exhibit #9

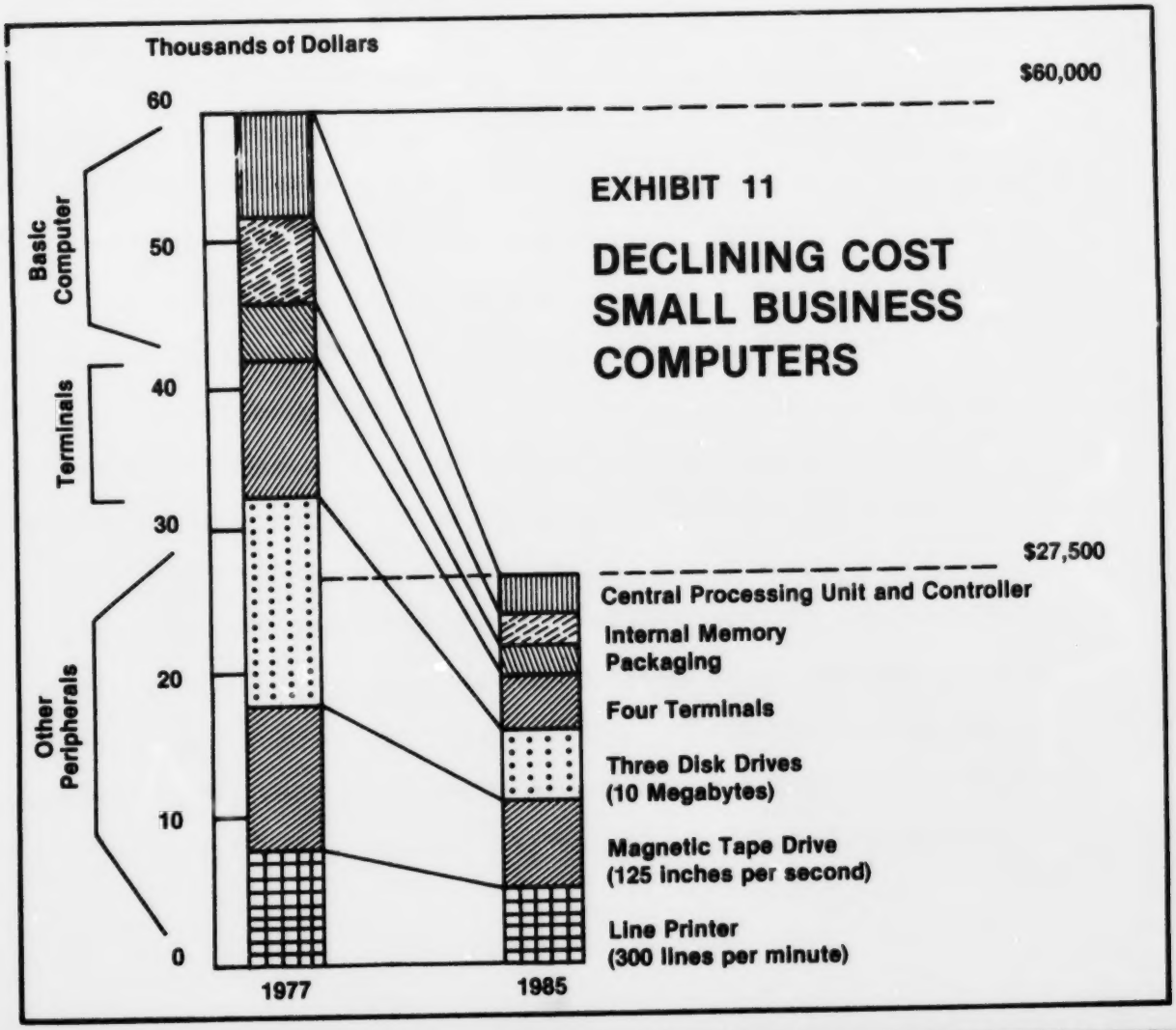



(Source: J.P. West, Western Electric Company)

Exhibit #10



The pattern of decreasing cost with concurrent improvements in performance and reliability has been characteristic of all computer system components. However, price reductions vary depending upon the combination of components involved. This is illustrated by a forecast made by Evans Research Corporation that a complete small business computer system purchased for $60,000 in 1977 can be replaced with a system of identical capability in 1985 for $27,500, a 45% reduction in total system hardware costs in eight years. Exhibit #11 documents this conclusion:[12]



As noted by a senior executive of Honeywell, "as prices come down, the base of the pyramid of users who can afford viable computer systems broadens dramatically."[13]

Telecommunications - Expanding Horizon

Canada is a world leader in the application of digital technology to the transmission of data. A key player is Northern Telecom which in 1981 will spend $150 million on R & D, funding the largest industrial R & D program in Canada.[14] This continues the momentum of R & D and capital investment by Canadian common carriers whose expenditures have, in total, far exceeded the cost of building the St. Lawrence Seaway.[15] The result of this research and capital investment has been advances in communication technology that have greatly reduced the cost, increased the speed and improved the reliability at which data is transmitted.

The Canadian leadership in telecommunications technology is especially significant because of our geography. Most business transactions in Canada occur in a narrow geographic corridor 3,000 miles long by about 350 miles wide, with the greatest volume being concentrated between Montreal and Hamilton. If one defines a non-local company as one with branches in the same city, in the same province, across the nation, or in other countries, then only about eight percent of the 175,000 enterprises in Canada are local-only operations.[16] The basic needs are to provide communication links between

widely geographically separated parts of organizations, and to provide services at the geographic extremities comparable to those available in central Canada.

While Canada was noted for its communication technology, the national networks up until the early 1970s were analogue. Circuit quality was designed to meet voice requirements; slow transmission speeds and background noise could be tolerated in voice communication. Point-to-point private analogue systems were developed for computer applications. However, such systems required the transmission of vast amounts of data to make them economically viable. The user paid a flat rate for the transmission line, whether or not it was being used. Since this rate was a function of distance, as computer communication distances increased, costs became more and more prohibitive. One solution was switched circuit communications over analogue lines. This reduced costs, especially over long distances, because users were charged on a pay-as-you-use basis. A link could be established with computers anywhere on the continent through direct distance dialing. While shared use of switched circuits lowered the costs, the circuits were not always of the high quality desired for computer communications. Also, switched circuit networks have relatively long call set-up times, which make them inappropriate for interactive applications. Several private systems were developed in an effort to overcome these problems.

However, the duplication of service in many geographical areas resulted in operation at a fraction of full capacity. More important, interconnection was hampered by a lack of standardization.[15]

A revolution in communications technology during the 1970s created vast new opportunities for the computer service industry. The major milestones were:

(a) In 1972 Telesat Canada launched a satellite that became the basis for the world's first domestic geostationary satellite system.[17]

(b) In 1973, the TransCanada Telephone System introduced Dataroute, the world's first nationwide, commercial digital data transmission system.[18]

(c) In 1977, Datapac, a universal, shared, intelligent digital network for data communications began commercial operation.[19]

(d) In 1978, the first international packet switched services commenced operation using Standard Network Access Protocol that had been ratified by the International Telegraph and Telephone Consultative Committee - thus, solving the standardization problem.[20]

Implementation of technological breakthroughs was facilitated by the formation of The Computer Communications Group of the TransCanada Telephone System. It includes:

(a) the ten member companies that provide telephone

service throughout Canada;

(b) Telesat Canada, the federal government and carrier-owned provider of satellite communications;

(c) CNCP Telecommunications, a common carrier that is a partnership between a Crown corporation and an investor-owned corporation; and

(d) Teleglobe Canada, a Crown corporation which provides the communications channels to link Canada to the overseas world.

These organizations provide compatible inter-connected service. Together they have sufficient influence to ensure that computer industry hardware manufacturers accept standardization policies pertaining to communications.[21]

The key to the superiority of digital transmission is in its performance. A digital signal can be regenerated at points along the transmission path. Analog signals can only be amplified, which also tends to increase the background noise levels and errors along the way. Also, circuit utilization can be increased through synchronous time division multiplexing. The economic advantage of Dataroute is based on shared use of common facilities of a system specifically designed for computer communication. Furthermore, diagnostic and operational features are built-in which might not be economical on private systems.[22]

A brief description of how Datapac works is essential

to enable the reader to understand how large a change in communication technology it represents. In the previous approach of circuit switching, a dedicated link was established over a trunk line between the two end users. With Datapac, the information to be transmitted is formed into packets, each with its own destination address code in a Header. To provide error control, a Frame Check Sequence is appended to the packet. The individual packets are routed through the communication network, travelling between nodes, which are specialized computers that decode the instructions contained in each packet header, check it for accuracy and route it towards its destination. Individual packets follow the optimum route at the time, based on traffic volume, trouble conditions and other factors. As each packet reaches a node, a copy is temporarily stored in a buffer. The copy is retained until the next node confirms that the original packet has arrived and is error free. If there is an error, the entire packet is automatically retransmitted from the last correct station. At the receiving node, the packets are gathered together as they arrive along different routes, extracted from their interleaved position amongst data from other senders, reassembled in their correct sequence, and delivered to their destination. Upon arrival, they are stripped of their Header and Frame Check Sequence, thus returning the data to its original configuration.[23]

Both Dataroute and Datapac have reduced communication costs. When Dataroute was introduced, the cost of transmitting digital messages decreased to one third ( on the average) of the previous leased line rates. Datapac reduced communication costs even further, especially for interactive processing. Cost comparisons are provided for typical applications in Exhibit 11A. In the examples given, new technology costs are 52%, 12% and 9% respectively of the current costs of communications via systems using prior technology. Since Datapac rates are based on volume of data transmitted (kilopacs per month), in the words of J.W. Muir, Communications Consultant with MT&T, "time and geography cease to be of consequence."

To complete the picture of rapidly advancing technology and declining costs, a brief discussion of satellites is also warranted. They have had a significant impact on the computer services industry by enabling worldwide shopping for service. Exhibit #12 illustrates the increases in communication satellite capacity and usage. Exhibit #13 shows the reduction in cost by a factor of more than 30, with concurrent improvements in performance.[24]

The Canadian market will be well served by Telesat's Anik 'C' satellites that will be launched in early 1982 followed by Anik 'D' later in the year. Anik 'C' will permit urban interconnection using the rooftop antenna concept. Connection of computers to these antennae with fiber optics will for the

Exhibit #11A

COMMUNICATIONS
COST COMPARISONS - OLD vs NEW TECHNOLOGY

I. PRIVATE LEASED LINE vs DATAROUTE

CASE #1: Distance - Halifax to Toronto (784 mi.)
Transmission Rate - 2400 Bits per second

A. PRIVATE LEASED (ANALOGUE) LINE

| | |
|---|---|
| Half Duplex Line (Signals can be transmitted in either direction, but not simultaneously) | $ 2,650. |
| Local Loops (City toll office to local site) | 50. |
| Data Sets (2) (Converts machine output signals to form suitable for transmission, and transmitted signals into machine input form) | 170. |
| TOTAL | $ 2,870./Month |

B. DATAROUTE (DIGITAL) LINE

| | |
|---|---|
| Dataroute Line (During business day, 07:45 A.M. - 10:00 P.M.) | $ 1,196. |
| Data Sets (2) | 300. |
| TOTAL | $ 1,496./Month |

RESULT: Cost of Dataroute is 52% Cost of Analogue Line.

Case #2: Distance - Halifax to Toronto
Transmission Rate - 300 Bits per second

A. PRIVATE LEASED (ANALOGUE) LINE

| | |
|---|---|
| Half Duplex Line | $ 2,650. |
| Local Loops | 50. |
| Data Sets (2) | 60. |
| TOTAL | $ 2,760./Month |

I. PRIVATE LEASED LINE vs DATAROUTE,

CASE #2

B. DATAROUTE (DIGITAL) LINE

| | |
|---|---|
| Dataroute Line | $ 120. |
| Data Sets (2) | 217. |
| TOTAL | $ 337./Month |

RESULT: Cost of Dataroute is 12% cost of Analogue Line.

NOTE: Saving is greater at slower transmission speeds which require a smaller bandwidth.

II. DIAL-UP vs DATAPAC

CASE #3: Distance - Halifax to Toronto
Usage - 1 Hour per day, 20 days per month
Dumb Terminal (CRT)
Fill screen, visually check, transmit

A. DIAL-UP (Dataphone)

| | |
|---|---|
| Fixed Costs: Use of line, modem | $ 57. |
| Variable Costs: Toll Charge | 1,032. (Approx) |
| TOTAL | $ 1,089./Month |

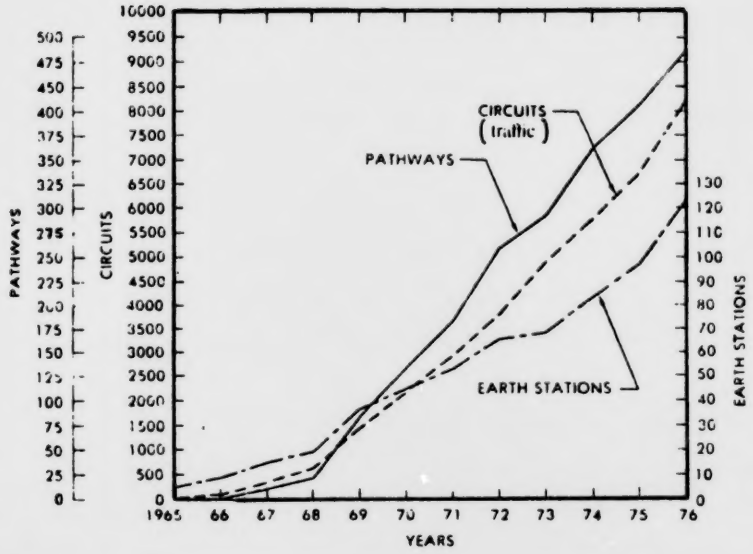
B. DATAPAC

| | |
|---|---|
| Fixed Costs: Dedicated 3101 Access | 70.00 |
| Variable Costs: Formatting (.78/K pac) | 0.78 |
| Transmission (.35/Kpac) | 0.35 |
| Line Holding Fee (2.5¢/Min.) | 30.00 |
| TOTAL | $ 101.00/Mo. |

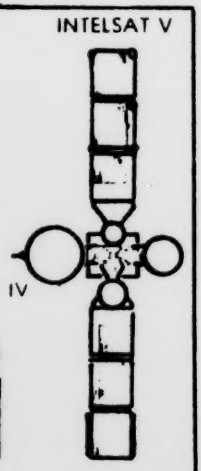
RESULT: Cost of Datapac is 9% Cost of Dial-up.

Source: J.W. Muir, Computer Communications Group, MT&T.

## Exhibit # 12




## Exhibit # 13




| | INTELSAT I | INTELSAT III | INTELSAT IV | INTELSAT V |
|---|---|---|---|---|
| YEAR OF FIRST LAUNCH | 1965 | 1968 | 1971 | 1979 |
| PRIME CONTRACTOR | HUGHES | TRW | HUGHES | FORD AEROSPACE |
| PRIMARY POWER (WATTS) | 40 | 120 | 400 | 1200 |
| TOTAL BANDWIDTH (Mhz) | 50 | 500 | 500 | 2300 |
| CAPACITY (TELEPHONE CIRCUITS) | 240 | 1200 | 4000 | 12000 |
| DESIGN LIFETIME (YRS) | 1.5 | 5 | 7 | 7 |
| COST/CIRCUIT YEAR ($) | 32500 | 2000 | 1200 | 800 |

first time enable computer to computer transmission speeds approaching processing speeds.[25]

The impact of these technological advances on the computer services industry is illustrated by a few examples:

(a) Peter Mason, President of Dymaxion reports that one of his regular customers is located in Australia. This customer uses the Dymaxion computer during Australia's normal business hours, taking advantage of Dymaxion's lower night time processing rates. Similarly, Peter McCauley, President of Micronet, uses a computer located in Hong Kong for the same reason.

(b) Norand Corporation polls point-of-sale terminals scattered throughout the Maritimes from its computer center in Toronto. This enables it to provide low cost processing of daily sales data.

(c) Gorden Brown of Mandala described how his company provides processing service to customers located in the Maritimes, Ontario and Saskatchewan using their computer in Dartmouth.

(d) Stephen Dow, Branch Manager for Digital Equipment of Canada Ltd., explained how technical faults of their client's computers located throughout the Maritimes can be remotely diagnosed by their computer in Dartmouth.

(e) Peter White, Manager of Atlantic Canada for Computel, described how his company does computer processing for financial institutions throughout Canada using remote batch input to their computers in Toronto.

It can be seen that data transmission cost reductions and performance improvements have, thus:

(a) increased the economic viability of using remote computers;

(b) increased competition by enabling consumers of data processing to shop around for the best buy (in terms of processing rates charged, application programs provided and other services); and

(c) enabled consumers of data processing to cross time zones to purchase computer time during low-processing-rate non-peak hours.

In the future, the fact that common carriers use computers at network nodes for message handling means that they could enter the computer service industry market as competitors of companies selling computer processing services. This would seem to be an appropriate use of excess capacity available during non-business hours. It also seems to be a natural follow-on to a capability to store data for transmission at night when rates are lower (called store-and-forward).[26]

Not discussed is the whole new range of computer applications that will be made possible when teledyne service is implemented. This is a large topic beyond the scope of this paper.

## III. Processing Trends

### Centralized Processing

The predominant processing trend in Canada from the early 1950s, when the first commercial computers were installed, until the mid 1970s was Integrated Data Processing (IDP).[27] This concept made efficient use of the large, expensive mainframe computers. Information processing was performed on behalf of the whole organization by a central computer department. Data was typically processed in batch mode and, indeed, the design of the mainframe computer was optimized for this method. Computer specialists planned, coordinated and controlled computer related activities. Centralization facilitated the setting of priorities and budgetary control. It also provided better growth opportunities for personnel, more qualified supervision and standardized procedures.[28]

### Service Bureaus

Firms that were not large enough to afford their own mainframe computer and staff of specialists hired service bureaus. The latter, having very high fixed costs, had difficulty surviving any periods when their facility's capacity was underutilized. Those that did survive founded the computer service industry.

Not all service bureaus were outside companies. It was not uncommon for a firm that had purchased a computer with excess capacity to sell processing time to other

companies. For this purpose, it would create a captive service bureau.

It was the sharing of costs that made the service bureau economically viable. Data processing was provided under contract in three modes:

(a) over-the-counter batch processing;

(b) remote-access batch processing; and later

(c) interactive processing.[29]

An example of a very large service bureau is Datacrown Inc., Willowdale, Ontario. Using seven large IBM computers, it offers all modes of processing. Datacrown's international communication network provides access to its computers and to a complement of software and technical support. It has over 1000 employees. The other very large service bureaus include Computel Systems Ltd, Ottawa, I.P. Sharp Associates Ltd., Toronto and Industrielle - Services Techniques, Montreal. I.P. Sharp has 360 employees located in all large cities in central and western Canada. It provides public data bases on banking, economics, aviation, energy, demographics, securities and insurance and business oriented applications software. A more typical example is Quasar Systems Ltd., Ottawa. Its offerings include financial, data base management and operations research services supported by a Hewlett-Packard 1000/40 computer. It has 130 employees.

Systems House

Some computer services companies provide more than just raw computing power. They provide consulting and application development assistance. Such firms categorize themselves as systems (or software) houses. The time-sharing computer is merely the mechanism by which they deliver the fruits of their labor.

Facilities Management

The introduction into Canada of the mini computer in the early 1970s and of the micro computer in the mid 1970s made it possible for many firms to buy their own computer systems. The customer base of service bureaus was, thus, threatened. One solution was for the service bureau to help the customer select a computer system and then to operate it for the customer. The development of remote diagnostic capability enabled the computer service companies to solve hardware or processing problems without having staff co-located with the user's computer. The user need not hire maintenance or programming personnel as these services could be provided. This approach proved attractive to companies that could afford the hardware and data input costs but could not afford to employ full time systems analysts, programmers and technicians. The approach was referred to as facilities management.

OEM Dealerships

Another reaction to rapidly decreasing hardware costs

was: if you can't beat 'em, join 'em. Some service bureaus obtained distributorships for computer hardware. They could, thus, combine consulting with original equipment manufacturer dealerships. This was especially attractive regarding the rapidly growing small business computer market.

Special Services

Yet another approach was provision of innovative services. One such service is public data base. This consists of collections of statistics on, for example, the economy of different countries, financial performance within various industries, stock market prices, airline schedules, and so on. Usually, support-type applications programs are also provided to help the user access and manipulate the data. The demand for this type of service is limited now, but is expected to mushroom as desk top and home computers become commonplace.

Some service bureaus have increased their 'value-added' by developing expertise in specific areas such as insurance, hospitals, the automobile industry and so on. Long lasting relationships are established with a small number of large clients that provide a substantial and steady cash flow.

Others offer data base management systems, computer output to microfilm facilities, or assistance in adapting software purchased through catalogue sales.

Frustration with Centralized Processing

In the late 1970s frustrations with fully integrated

and centralized data processing became apparent. More important, the declining costs of mini and micro computers provided a viable alternative. Departments not satisfied with the service provided by the centralized data processing department or service bureau could afford to buy their own hardware.

There were several causes of dissatisfaction. Installing a fully integrated system in the first place required a very long lead time. The planning task was monumental, since all data requirements and inter-relationships had to be taken into account for the entire organization. You couldn't just buy a computer, plug it in, remove a program from a blister-pack and run it. Rather, a one or two year planning and implementation phase was common. Many executives became impatient with this delay.

Also, the backlog in programming work and the difficulty inherent in changing any aspect of a program that had numerous complex inter-relationships with other programs, often resulted in months of waiting for what seemed, to the user, to be a simple change. The user departments came to believe that if the monolithic centralized management information system were replaced with decentralized data processing, user control of resources would ensure the system became responsive to their needs.

Another problem was that centralized processing tended to also be batch processing, with data flowing on manually

completed paper forms from the data source to a central department. There it would be verified and entered into the computer. This paper flow resulted in additional administrative work and input of non-current data. Also, errors were corrected by recycling the documents through the paper flow network. Data entry and verification at source was clearly superior - and the administrative work saved could offset the inefficiencies of decentralization.

Decentralized Processing

The initial response to these problems was decentralized processing which is a system where each branch (or department) maintains files and does its own processing independent of other branches or corporate headquarters.[30] Unfortunately for the organization using this system, the random mushrooming of these autonomous computers resulted in out of control data processing budgets. The solution provided by the computer/communications industry was distributed data processing.

Distributed Processing

Distributed processing is a data processing alternative whereby a small business computer is installed at the user's location for on-site processing, but is linked to a larger centralized computer, which may be either an in-house computer or service bureau equipment. The on-site computer's data storage and processing capability allows the user to perform much of its data entry and processing workload without having to pay access, communications and other

charges associated with using a computer service company's main computer. The in-house system can,however, call-up the service company's computer when required for accessing larger files or for performing processing beyond the capability of the in-house system.

The system design concept has two essential features. "The first is the physical distribution of an organization's data files and processing workload to the actual locations where the relevant manual work is performed. The second aspect is that data (and even processing) resident on any particular system (at any location) is accessible to all other locations on a real-time or on-line basis."[31]

Inherent in the concept is the implication that central management oversees the use of computers within the company, and that computer systems are implemented with corporate goals in mind.

What makes distributed processing possible is the low cost of minicomputer and microcomputer hardware, the small size and reliability of these devices and their ability to talk to each other.

Large firms can have distributed processing entirely in house, with, for example, a warehouse, production department and marketing department each having micro-computers linked to a mini-computer located in the finance department.

Shared distributed processing can also be combined with the facilities management concept. The various possible

permutations provide growth opportunities for computer service companies in the face of rapidly declining hardware costs.

As a processing option, the future of distributed processing is solidly assured because it allows the integration of data processing into the operation of the organization rather than the other way around.[32]

Decentralization has de-emphasized the role of in-house specialized computer services staffs and has provided new opportunities for outside firms selling consulting services and software. Also, as computer facilities come under the control of individual departments (such as marketing, production, research and development, etc.) many new applications become evident.

## IV. Business Application Trends

A complete analysis of business application trends is beyond the scope of this paper. However, a few basic points merit highlighting. A discussion of the trend towards more sophisticated applications will be followed by a summary of a recent Canadian survey.

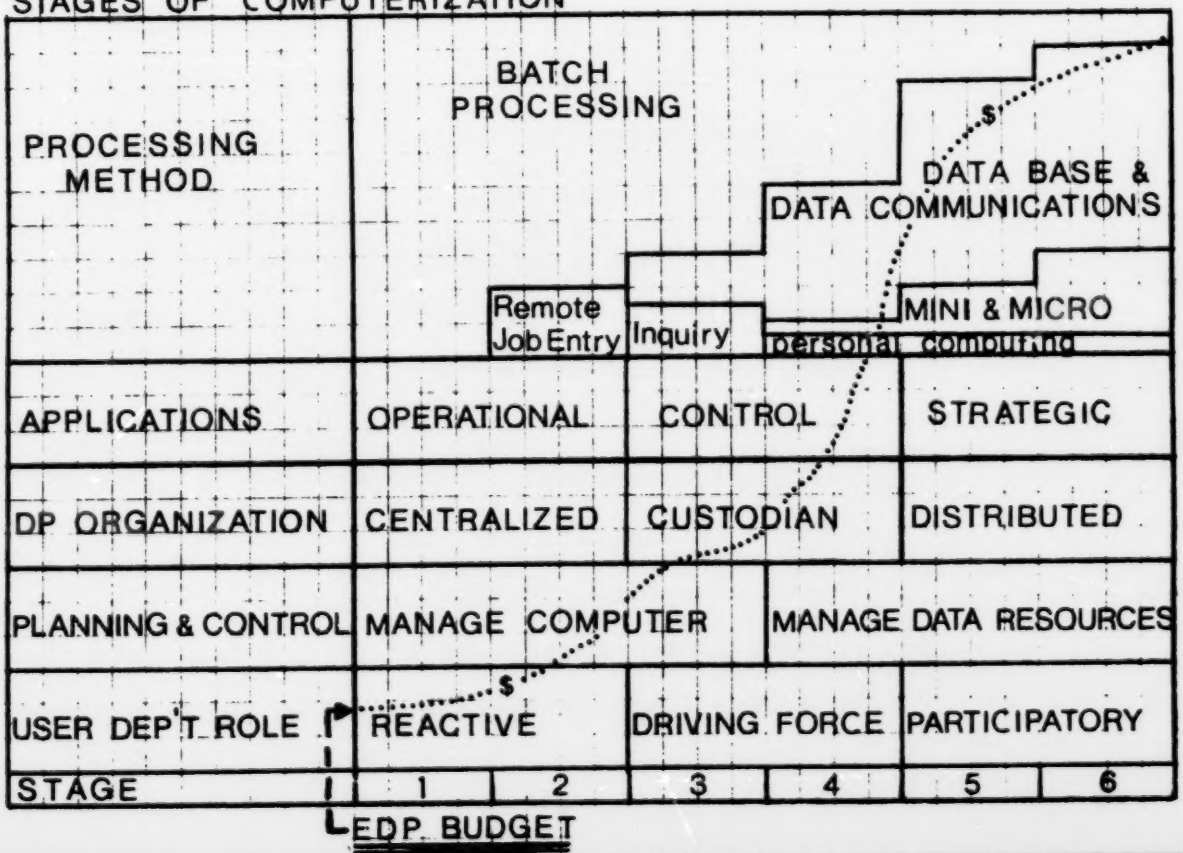
Rarely is a company 'computerized'in a one-step process. Rather, the tendency is to start with relatively simple and obvious applications such as accounts receivable, inventory control and payroll. Later management control systems are implemented, for example, budgetary control and sales analysis. The final stage is computer assisted strategic

decision making. Illustrations are forecasting, modeling and simulation programs.

Because so many firms entered the first stage within a time span of only a few years, many implementation plans are 'in-phase'. This has put pressure on the computer service industry. It must not only accommodate an exponential growth rate of initial installations, it must also produce ever more sophisticated software to support later stage applications.

The compensation for this pressure is the revenue growth pattern. Individual firm's electronic data processing budgets tend to follow an S-shaped curve. As many Canadian firms move more or less in phase along this curve, the cumulative effect is accelerated data processing revenue growth.

Exhibit #15
STAGES OF COMPUTERIZATION



The S-shaped EDP budget curve was analyzed in great detail by R.L. Nolan. The much simplified version shown on the preceding page (Exhibit #15) is based on an article published by him in 1979.[33]

While the S-shaped curve phenomenon has had the greatest impact on computer service industry revenue, there are other major important trends.

In January 1978, the Information Institute of Canada published the results of a survey of large Canadian firms that used computers. The objective of the study was to forecast the information processing trends in Canada for the period 1980 - 1985. The results may be summarized as follows:[34]

(a) There will be greater emphasis placed on more sophisticated applications, as discussed above.

(b) The trend towards centralized processing using large service bureau or in-house computer facilities is being displaced by a trend towards decentralized or distributed data processing systems developed around small computers.

(c) The change from stand-alone to remote batch processing is largely complete. The emphasis will shift to on-line interactive terminal processing using advanced data base concepts.

(d) There will be greater use of public data networks to access computer systems in other organizations.

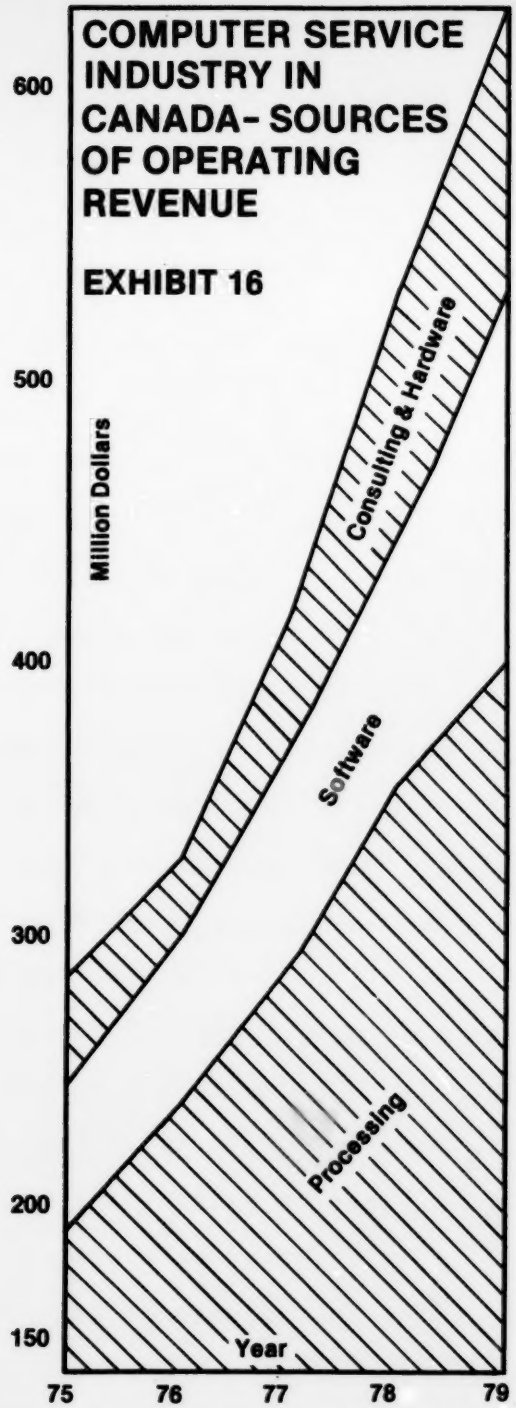
(e) Office automation trends will focus on word and text processing, computer graphics and microfilm facilities.

Smaller firms with less experience with electronic data processing have less sophisticated concerns. There the emphasis is on first level applications. Various studies indicate that somewhere between 2% and 10% of this market has been tapped.[35]

V. Revenue Sources

The hardware, processing and application trends described above explain the computer service industry revenue trends documented in Exhibit #16. (The total revenue indicated is less than that shown in Exhibit #2 because firms that obtain less than one third of total operating revenue from the sale of computer services are excluded. That is, those firms that rely primarily upon the sale, lease or rent of hardware, but obtain some revenue from the sale of software, consulting services, etc. are classified as FDP hardware suppliers.)

Exhibit #17 provides a breakout of revenue by category of user.

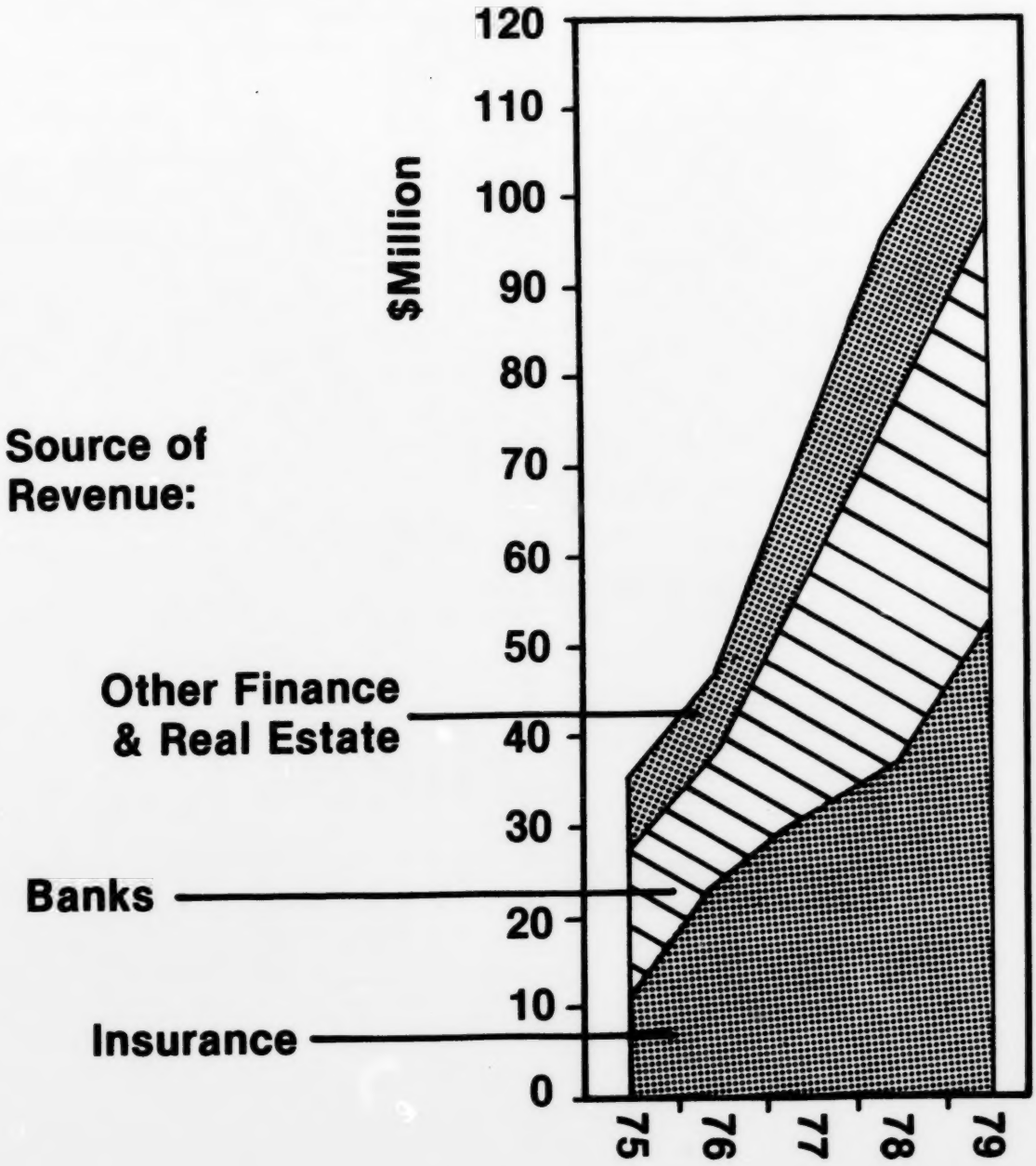


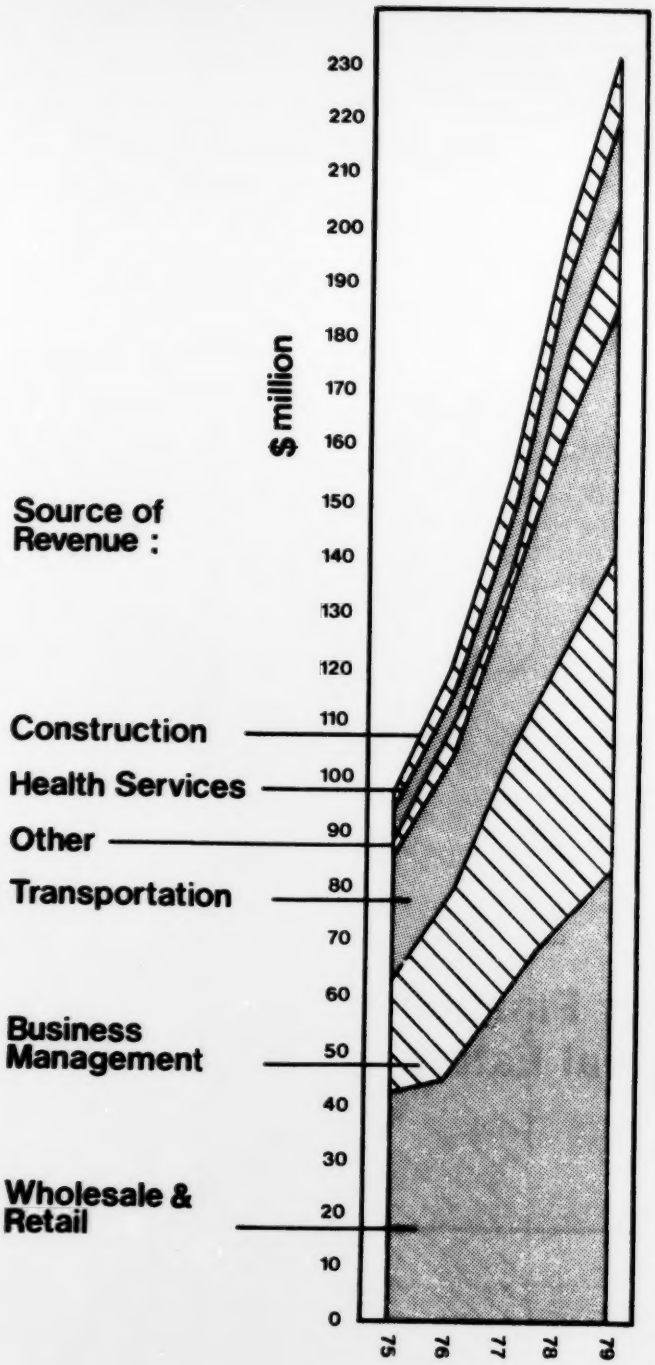

Source: Statistics Canada Catalogue 63-222 Annual

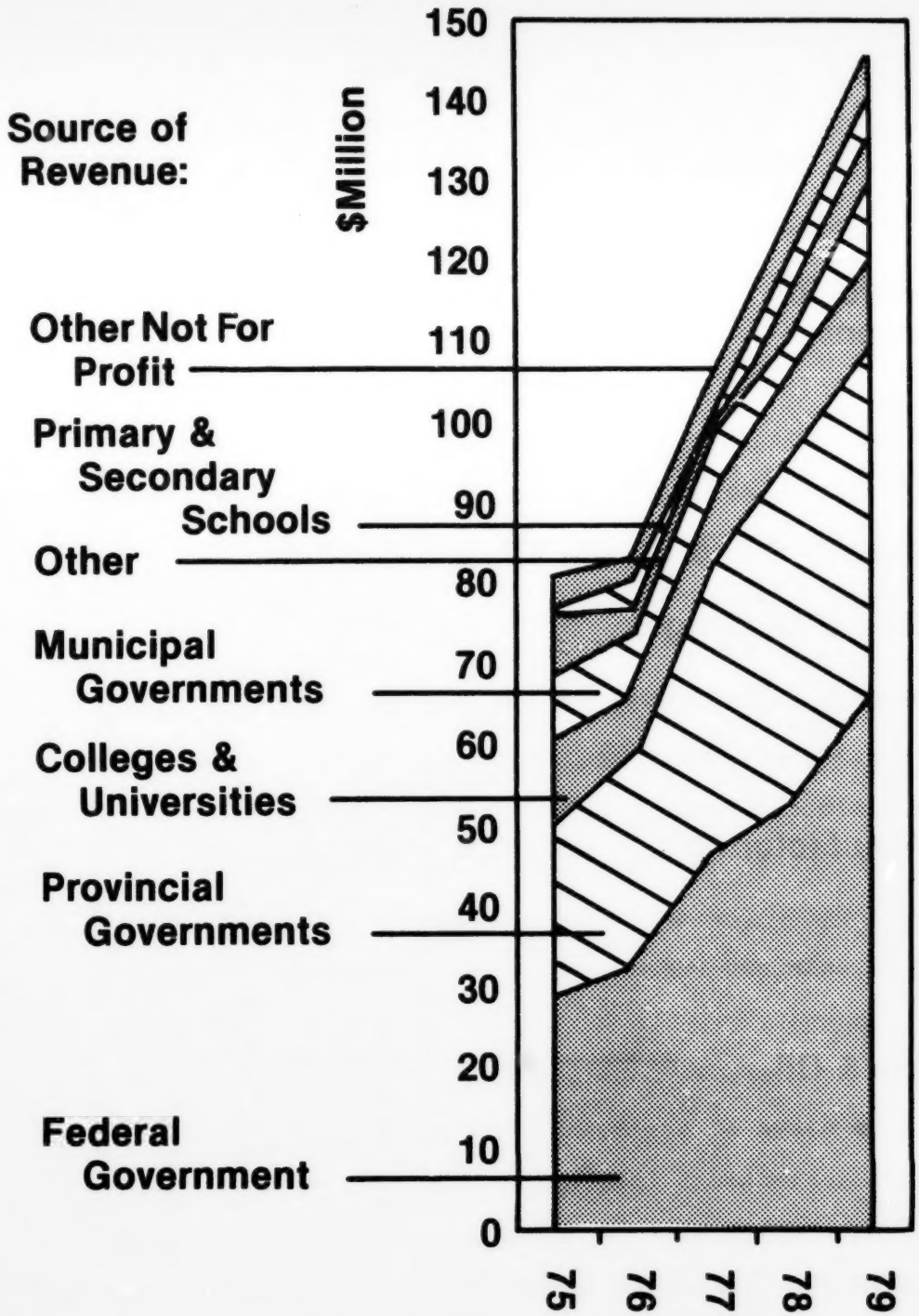
EXHIBIT #17

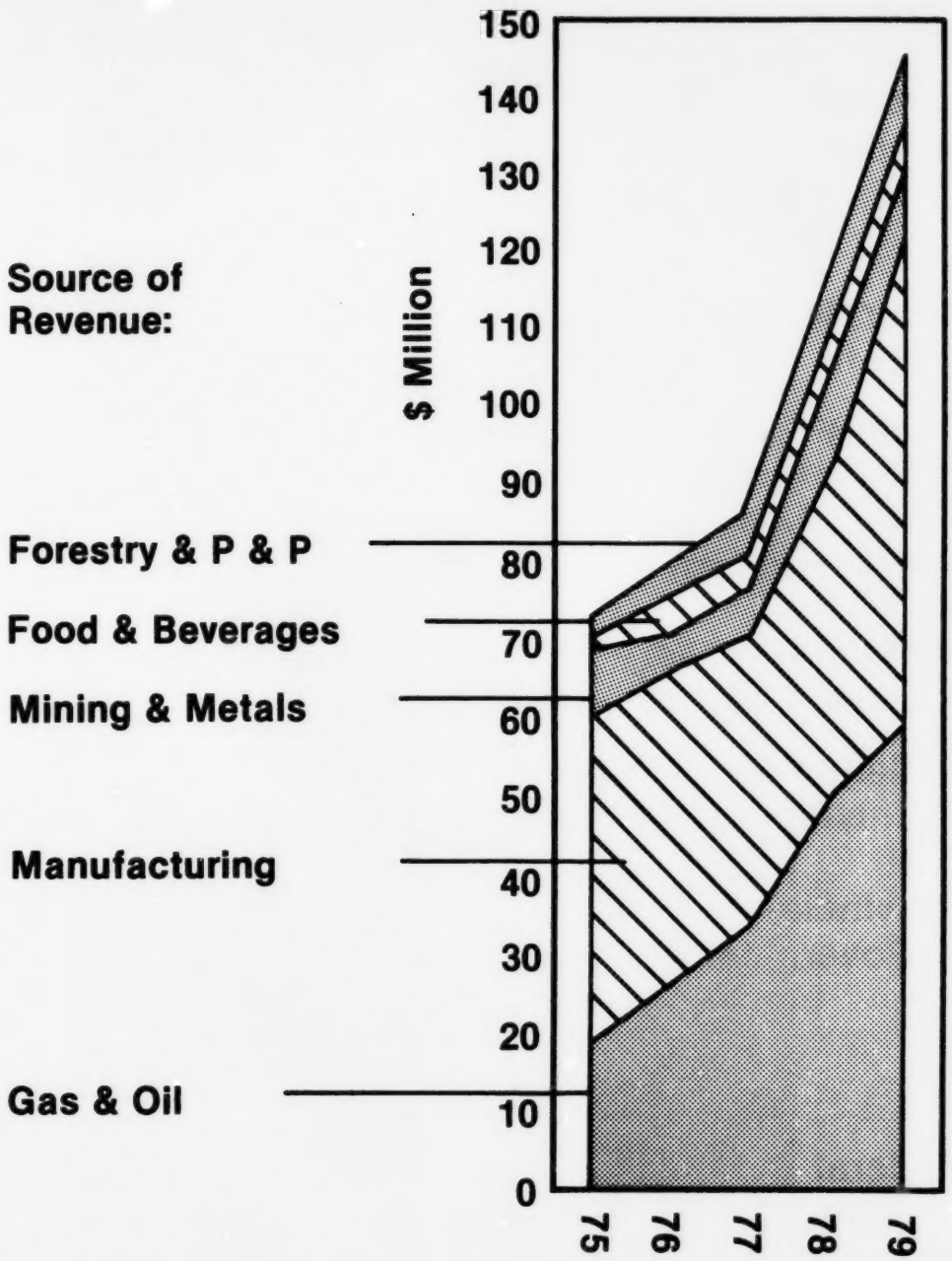
## COMPUTER SERVICE INDUSTRY: SOURCES OF REVENUE

| BY REVENUE VOLUME | BY REVENUE GROWTH |
|---|---|
| 1. FORESTRY, MANUFACTURING, MINING | 1. FORESTRY, MANUFACTURING, MINING |
| 2. GOVERNMENT | 2. CONSTRUCTION |
| 3. FINANCIAL INSTITUTIONS | 3. SCHOOLS |
| 4. SERVICES | 4. TRANSPORTATION |
| 5. WHOLESALE & RETAIL | 5. FINANCIAL INSTITUTIONS |
| 6. TRANSPORTATION | 6. WHOLESALE & RETAIL |
| 7. SCHOOLS | 7. GOVERNMENT |
| 8. CONSTRUCTION | 8. SERVICES |
| 9. OTHER, NOT FOR PROFIT | 9. OTHER, NOT FOR PROFIT |




$ million
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
75
76
77
78
79
Source of Revenue :
Construction
Health Services
Other
Transportation
Business Management
Wholesale & Retail


Source of Revenue:
$Million
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
Other Not For Profit
Primary & Secondary Schools
Other
Municipal Governments
Colleges & Universities
Provincial Governments
Federal Government
75
76
77
78
79




**Source: Statistics Canada**
**Catalogue 63 - 222 Annual**

## VI. Impact of the Economy

The strategic plans of many Canadian companies must be based on a painful adjustment to economic slowdown. The Federal government forecasts a growth in Canada's GNP of only 0.2% in 1981. Inflation is currently running at 12.5%. The nation-wide unemployment level is 8.7%. Newspapers carry stories of the financial problems of such giants as Chrysler and Massey Ferguson.

The computer industry is only marginally affected by these problems. The main reason is that firms that are cutting back are looking for ways of improving productivity. As explained by Ronald Smith, V.P. Operations, Wang Can. Ltd., "a company that previously billed $25 million annually, but has now dropped back to $15 million, is a prime candidate for computerization." He also notes that "small businesses that feed the auto industry giants have been busy retooling for downsized cars, and, as a result, Wang's sales in that area have been robust."[36] Reynolds and Reynolds, which specializes in providing services to the auto industry has also sustained its high rate of growth.

Another factor is that many large customers of the computer services industry are prospering in spite of the general economic conditions. Financial institutions are reporting record profits generated by larger than usual margins between the rates at which they borrow and lend.

In spite of all the fuss over oil pricing, the oil industry is recording high profit levels. These are but a few of many possible examples. The expansion programs of highly profitable firms tend to include increased expenditures on electronic data processing.

The only computer service firms that face real difficulty are those that sell raw computing power. This is a variable cost that customers who are cutting back seek to trim. Also, the stiff competition between providers of processing capacity has driven margins to a low level.

## VII. Government Role

The Federal government policy regarding the computer industry recognizes the dominance of American hardware manufacturers. Its approach is promotion of the communications industry and of the computer services sector. For example, the Foreign Investment Review Agency recently rejected two proposals from foreign firms that wished to establish subsidiaries in Canada to provide computer services in the Toronto area.[37]

Also the Federal government contracts out much of its electronic data processing work. Wayne Champniss of the Nova Scotia government Data Center indicated that the provincial government followed a similar policy. In both instances the government objective is to foster the growth of the computer services industry.

An issue that has received much attention recently is transborder data flow. Between #300 million and $500 million worth of computing services were imported into Canada in 1978.[38] Electronic signals flowing across borders are not subject to duty, even though they constitute a revenue generating product. This makes it possible for extremely large American service bureaus to take advantage of their financial strength, undercutting the prices of smaller Canadian firms. This concern is lessened by market factors such as the difference between Canadian and American accounting procedures, tax laws, etc. Many American business computer application programs are thus not applicable in Canada. It is not surprising that a computer data survey revealed that most Canadian computer service industry firms were against any legislation by the Canadian government restricting transborder data flow.[39]

Of greater concern is the possibility that multinational corporations may decide to consolidate computer operations at their headquarter sites outside of Canada. Francis Fox, Minister of Communications in the Federal government stated that,"As a government, we must take great care that this does not lead us to a position in data processing comparable to that in which we find ourselves with regard to research and development."[40] However, he did not indicate any government intention to take action, perhaps because of the practical difficulties involved in regulating a company's internal

information handling procedures.

G.G. Murray, President of the Canadian Business Equipment Manufacturers Association believes that the Canadian computer services industry is harmed by the duties and Federal sales tax on American manufactured computer hardware. He argues that the 25% higher hardware costs make it difficult for Canadian data processors to offer competitive rates. On large mainframe computers 25% would obviously represent a very large dollar amount. However, there does not seem to be a concerted effort to bring about legislative change.

In summary, the government role in the computer services industry seems to be largely that of a major source of revenue. There are few regulations specifically aimed at this industry.

## VIII. Competing Providers of Software

According to one Canadian computer expert, "The most severe constraint on the growth of the computer industry as a whole in 1981 will continue to be the applications software development bottleneck."[41] Many alternative competing providers of software are striving to meet the escalating demand. More than 800 firms in Canada offer application software. Nine categories of supplier are discussed briefly below with the focus being the impact on the computer services industry.

### In-House Development

A 1980 survey of Financial Posts top 500 firms in Canada revealed that 75% of these large companies develop their own applications software, although about 50% of the firms rely on other sources as well.[42] This approach gives the user complete control over all aspects of development, thus ensuring that programs meet the company's needs. Also, it is currently unavoidable because the demand for software far outstrips the supply. "However, skyrocketing costs, missed deadlines, the problems of attracting, motivating and retaining the needed technical staff, etc. have all contributed to the decline in the attractiveness of this source of application software."[43]

'Programmerless systems' may facilitate increased in-house program development in the future. Vista Computer Inc. offers a system called Datascan that enables users to

create their own applications 'without applying conventional programming skills.' The system leads users through each operating step, providing the appropriate cues to follow as well as indications whenever errors occur.[44] Some service bureaus are also now using similar systems to improve programmer productivity.

User Groups

"A number of hardware and software vendors have user groups which meet periodically to exchange ideas and programs. Programs exchanged through these groups are not generally supported by the vendor (unless acquired by the vendor for marketing purposes)."[45] Also, the quality of such programs is variable.

Computer Manufacturers

As hardware costs have declined, market competition has resulted in decreasing profit margins on a per unit sold basis. For example, the semiconductor industry has suffered a "31 per cent fall in its average return on equity funds in the past five years and an 18 per cent decline in pre-tax profit margins."[46] While the end-product manufacturers have not been as hard hit as the component suppliers, they have taken note of the trend. At the same time, the margin on software has remained good and the proportion of revenue from software has grown. Digital Equipment of Canada reported that services (including software sales) "are an increasingly important part of the business. As a percent of total revenues, the services

portion grew from 9% ten years ago to 25% in Digital's last fiscal year."[47] Thus, the service sector of the computer industry can expect increasing competition from the computer manufacturers. This will be especially true as "manufacturers recognize the sales leverage that good application software can provide."[48]

Turnkey Suppliers

A turnkey system is "an integrated system of computer hardware, operating systems, application programs and related services and products purchased by the buyer in a complete package ready for operation."[49] Turnkey sales have experienced rapid growth over the past few years, largely through the sale of mini and micro computers to small businesses. This approach relieves the purchaser of the headaches associated with software and hardware acquisition, modification, testing, documentation and installation. If the purchaser is satisfied with the turnkey system provided, he will likely turn to the same supplier for additional software packages as they become needed. This is particularly true if the new programs must be compatible with a proprietary data base system. Thus, turnkey suppliers are increasingly potent competitors of service bureaus and software houses.

Catalogue Sales, Software Brokers

Exhibit #18 provides an illustration of the wide range of software that is now available in the form of application

packages. Nearly 200 new or enhanced software packages were listed in Infosystems eighth semiannual Software Info Review:[50]

Exhibit #18

Compute depreciation - Resource Software International Inc. has enhanced its Fixed Asset Control with a Fixed Assets Depreciation Package including source code, geared for any business requiring depreciation of fixed assets. It can accommodate any number of items, limited only by the capacity of the Datapoint computer it is designed to run on. Circle 418

Project control system - Project Control/70 is a system from Atlantic Software Inc. designed to control costs and status; forecast schedules, costs and workloads; pinpoint trouble areas; simulate schedules; chargeback and account for costs; and measure performance. The system operates on IBM, Burroughs, UNIVAC, DEC and Honeywell systems. Circle 344

The Infosystems list included numerous programs under each of the following headings:

Exhibit #19

| | |
|---|---|
| Data Base Management Systems | Project Control |
| Information Storage and Retrieval | Utilities |
| Data Dictionary/Directory | Job Accounting |
| Operating Systems and Enhancements | Librarians |
| Performance Evaluators | General Accounting |
| Programming Aids | General Ledger |
| Systems Development | Payroll and Personnel |
| Systems Management | Financial (Industry) |
| Manufacturing & Inventory Control | Insurance |
| Mathematical and Statistical | Graphics |
| Forecasting/Estimating | Security |
| Accounts Receivable/Payable | Text Processing and |
| Medical and Health Care | Specialized Programs |

"Several companies now act as brokers between software developers and purchasers. Their contribution to the developers is often national or international marketing and distribution capability."[51]

Software packages purchased through catalogue sales or from brokers can be delivered in various forms, including on floppy disks and tape cassettes. Texas Instruments and Hewlett-Packard sell programs impregnated into silicon chips in the form of read-only-memory (ROM). Norand transmits programs by telephone to its customers who can use inexpensive equipment to receive and store the program in micro computer 'firmware'.

Procurement from brokers or catalogues does have the disadvantage of lack of follow-on support and need to adapt the program to the unique aspects of the user's business. However, mass marketing results in such low prices that many users are quite willing to live with these problems.

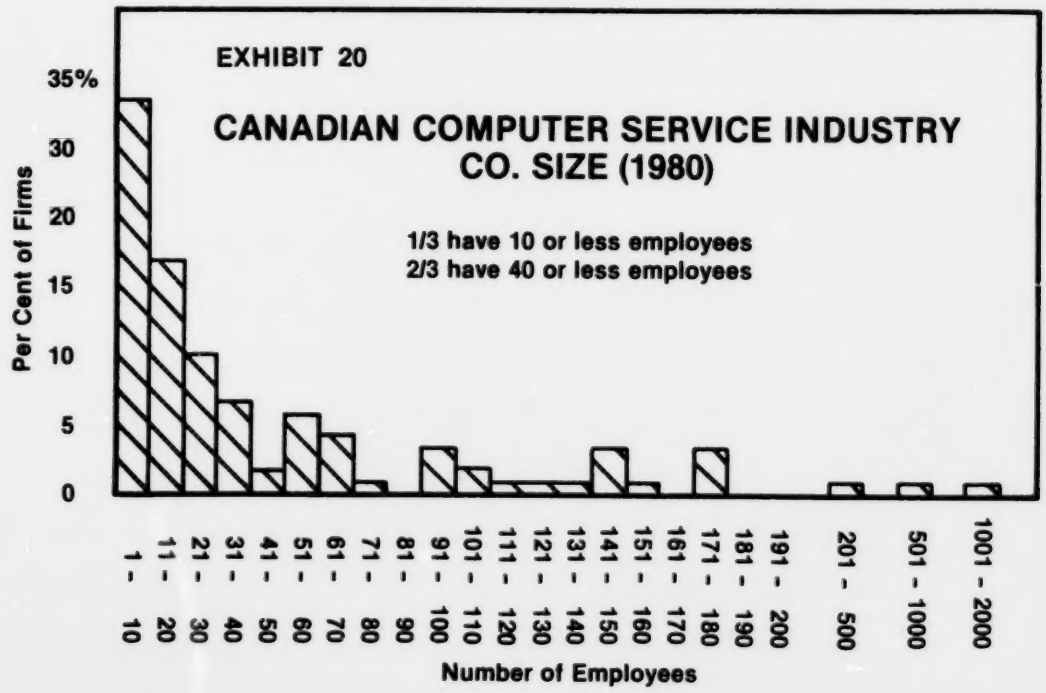
The possibility of mass marketing software points to the need for marketing research to better define user needs. Very little has been done.

Independents

According to Chris Morgan, editor of the home-computer-enthusiast magazine 'Byte' (with 100,000 subscribers). "Bright people are sitting with computers in their basements and turning out software that is getting very, very good. They are often one-man companies with crazy-sounding names. But the cottage industry is real and growing."[52] Even when such firms have several employees, they tend to be dependent on a few knowledgeable people, to have high technical staff turnover and to be interim solutions to the proprietor's

employment needs. They market their product directly to customers, through brokers, or through computer stores. Given their low overhead, they can easily undercut the prices of larger firms.

Very small firms are the most common in the computer services industry as shown in Exhibit #20:[53]




Computer Stores

"Originally only in the hobby computer market, these organizations were quick to respond to the sizable small business application software market.....While computer stores are not generally a good source of application software right now, they can be looked to as better sources in

the future."[54]

Universities

The computer departments of Canadian universities develop software, often selling it to each other. Some work under contract to major computer firms. For example, Honeywell is fortunate in having two universities do software research and development for it. The University of Waterloo has created compilers and communications software and Carleton University has written application packages.

Service Bureaus and Software Houses

The most obvious source of software has been intentionally listed last so as to highlight the fact that there is fierce competition, even though the demand exceeds the supply. Most service bureaus in Canada are still relatively small with less than $8 million in annual sales,[55] although there are a few with revenue in the order of $60 to $80 million annually. Service bureaus generate most of their revenue from processing. The income from selling software is generated mostly by doing custom development work. As a result of strong price competition, internal quality control mechanisms may be given short shift.

In spite of these problems, they are the alternative best able to provide sophisticated applications programs tailored to the user's specific needs.

IX. Shortage of Programmers

A review of computer industry trade journals gives the impression that the biggest problem facing the Canadian computer

service industry is the shortage of programmers. The following statements define the magnitude of this problem:

(a) The demand for computer programmers exceeds the supply by at least 5000 people.[56]

(b) Canada will need 7000 new programmers per year until at least 1985 if the data processing industry continues to grow at over 20% per year - this exceeds the number graduating annually.[57]

(c) The industry is between three and five years behind in developing the applications needed today.[58]

(d) The overseas supply of skilled software personnel dried up in 1977 when the British economy began to regain strength. The U.S. was a major source of talent during the Vietnam crisis. Now there is a net loss of Canadian talent to American companies that provide ample research and development facilities, an exciting working environment with a variety of challenges and an attractive lifestyle in the sun belt.[59]

(e) In the average electronic data processing installation, up to 80% of the staff and resources are committed to system maintenance, and, thus, not available for development of new applications.[60] Software maintenance is tedious work shunned by many programmers.

(f) Turnover of skilled personnel is the highest of

any industry, the average time with one company even for executive positions being less than two years.[61]

(g) Both management and employees are, on the whole, young, bright and knowledgeable people, but many lack business experience and maturity.[62]

The ability of Canada's colleges and universities to solve these problems is limited by government funding cutbacks, by internal disputes over available funding as some departments are forced to retrench, and by the lack of qualified instructors. A few universities are making major contributions. Algonquin College in Ottawa, the largest community college in Canada, has a well established computer studies department that currently trains about 285 graduates a year.[63] The University of Waterloo prepares its students for the business environment through a co-operative program that provides the student with two years of work experience prior to graduation. The Alberta Institute of Technology (Northern and Southern) uses a similar approach.

The computer industry augments the output of educational institutions with in-house training. The computer manufacturers are still the leading producers of programming talent. However, it is becoming increasingly difficult to recruit from the large manufacturers such as IBM, Univac, Control Data and Burroughs.[64] Some large firms have entered the "education business", setting up training institutes. Examples are

Control Data and Art Benjamin and Associates.[65] While some major users of programming talent such as Bell Canada and Digital Equipment Corp. train their own people,[66] many companies have dropped their training programs, putting their money into recruiting instead. They were losing too many people to other firms after having trained them.[67]

The shortage of talent resulted in increases in salaries in the order of 10 percent in 1979. Current salary levels are tabulated below.[68] Bear in mind that these are average salaries; some firms must pay much more to recruit needed talent.

Exhibit #21 Salaries ($000) Canadian Computer Services Industry (1980)

| Edmonton/Calgary | Montreal | Toronto | Vancouver | |
|---|---|---|---|---|
| **Non-Management Positions** | | | | |
| **Commercial Programmers and Programmer Analysts** | | | | |
| 15.8 | 15.9 | 15.7 | 16.1 | 6 months-1 year |
| 25.2 | 25.7 | 24.5 | 25.9 | Over 4 years |
| **Engineering/Scientific Programmers and Programmer Analysts** | | | | |
| 16.6 | 16.1 | 16.0 | 15.8 | 6 months-1 year |
| 27.3 | 26.3 | 25.9 | 25.5 | Over 4 years |
| **Mini/Micro Computer Programmers and Programmer Analysts** | | | | |
| 16.3 | 16.4 | 16.2 | 16.6 | 6 months-1 year |
| 28.3 | 28.8 | 27.6 | 29.0 | Over 4 years |
| **Systems (Software) Programmers** | | | | |
| 21.6 | 22.2 | 20.9 | 20.8 | 1 year-2 years |
| 30.6 | 31.2 | 30.6 | 30.8 | Over 4 years |
| **Data Base Specialists** | | | | |
| 22.2 | 22.4 | 21.8 | 22.2 | 1 year-2 years |
| 31.6 | 31.9 | 31.0 | 31.8 | Over 4 years |
| **Data Communications Programmers and Programmer Analysts** | | | | |
| 22.9 | 23.1 | 22.6 | 23.3 | 1 year-2 years |
| 30.8 | 31.2 | 30.2 | 31.1 | Over 4 years |
| **Documentation Specialists** | | | | |
| 16.1 | 16.3 | 16.0 | 16.4 | 6 months-1 year |
| 24.2 | 24.5 | 23.5 | 24.9 | Over 4 years |
| **EDP Auditors** | | | | |
| 21.0 | 21.2 | 20.9 | 21.3 | 1 year-2 years |
| 32.0 | 32.5 | 31.2 | 32.7 | Over 4 years |
| **Senior Analysts, Project Leaders and Consultants** | | | | |
| 25.1 | 25.3 | 25.0 | 25.5 | 2 years-4 years |
| 31.5 | 31.8 | 31.2 | 31.9 | Over 6 years |

| | | | | |
|---|---|---|---|---|
| **Management Positions** | | | | |
| **Technical Services Managers** | | | | |
| 32.8 | 33.2 | 31.8 | 32.9 | Small |
| 35.0 | 35.5 | 33.9 | 35.2 | Medium |
| 37.9 | 37.5 | 36.8 | 37.1 | Large |
| **Systems and Programming Managers** | | | | |
| 29.2 | 29.4 | 28.9 | 29.6 | Small |
| 33.7 | 33.9 | 33.3 | 34.1 | Medium |
| 38.8 | 38.8 | 38.1 | 39.1 | Large |
| **Operations Managers** | | | | |
| 23.9 | 24.2 | 23.3 | 24.4 | Small |
| 27.5 | 27.8 | 26.7 | 28.0 | Medium |
| 32.3 | 32.6 | 31.4 | 32.7 | Large |
| **Information Systems Directors** | | | | |
| 32.7 | 32.5 | 31.7 | 33.2 | Small |
| 40.0 | 40.6 | 38.8 | 40.3 | Medium |
| 48.5 | 49.1 | 48.2 | 48.7 | Large |
| **Marketing Positions** | | | | |
| 39.8 | 38.7 | 37.2 | 38.0 | **Marketing Representatives** |
| 49.5 | 50.7 | 48.4 | 49.1 | **Marketing Managers** |
| **Marketing Technical Support Representatives** | | | | |
| 21.6 | 21.7 | 21.5 | 21.9 | year-2 years |
| 24.0 | 24.5 | 23.7 | 25.1 | 2 years-4 years |
| 29.7 | 30.3 | 29.3 | 30.4 | Over 4 years |

The salaries tabulated on the previous page need to be put into perspective. Computer science university graduates make less than engineering graduates. Computer programming community college graduates make less than those with technology diplomas.[69] A few illustrations are:

University

| | |
|---|---|
| Computer Science | $ 16,280 |
| Computer Science Co-ops | 17,520 |
| Geology | 18,820 |
| Chemical Engineering | 18,400 |
| Electrical Engineering | 17,640 |

Community College

| | |
|---|---|
| Computer Programming | 14,110 |
| Electronics | 14,330 |
| Metallurgical | 15,990 |

Douglas McCann, an economist employed by Computel, points out that the shortage exists only "at the prevailing wage rate... If firms increased their wages, more workers would be willing to offer their skills." He also points out that restrictions of labour supply can occur because of the recruiting practices of firms. Many programmers who would generally qualify for a given position do not apply or are not accepted because the required qualifications are too narrowly defined. He gave several examples, a typical one being: .."Qualifications include a minimum of Grade 12 and two years of related post-secondary training as well as 2-3 years experience writing COBOL programs in a business environment on an IBM 370/135 384K DOS/VS computer installation....." Thus, he views the argument documented on preceding pages to be excessively alarmist.[70]

While he is probably correct, the need to obtain skilled people should clearly be central to computer services industry corporate strategy. In the words of Peter White, Manager of Atlantic Canada, Computel, "What we are selling is expertise" - to do that one needs enough people, and they have to be people with the right skills.

## X. Industry Rationalization

### Acquisitions, Mergers

Lately, profit margins in the computer services sector have been nosediving, to an estimated 1.6% of sales in 1979 from a high of 6% as recently as 1977.[71] This is largely due to the numerous takeovers during the past few years. Examples are: Systems Dimensions Ltd. was merged with Datacrown, Multiple Access merged with Canada Systems Group, and Computel acquired SDI.[72] This consolidation strategy has several possible explanations. One is that it is a way of sustaining a high rate of growth in spite of a shortage of programmers and systems analysts. The acquired firm is a source of skilled staff, proprietary software and additional customers. Another explanation is that a small number of very large service bureaus are seeking positions of market dominance, with the intent of gaining from the positive correlations between market share and profit level. Market dominance is becoming a practical strategy because the dramatic reductions in communication costs with simultaneous improvements in performance makes it

possible to offer services in geographically dispersed markets at rates that reflect the economies of scale of extremely large data processing centers. This argument is strongly supported by one industry analyst who points out that: "Four firms at the end of 1979 or early 1980 account for more than 80 percent of retail remote computing sales in Canada. Using the business strategy of leveraging the experience curve, these firms are striving to achieve market share, often by exercising price leadership."[73] The consulting firm, Peat, Marwick and Partners, predicts that "it is quite possible that we will see no more than two, or perhaps three, major computer service bureaus in the country and probably as few as 20 or 30 per cent of the existing service bureaus surviving in the longer term."[74]

Another fact worth noting is that the largest Canadian computer service firms are all subsidiaries of giant corporations that require a great deal of data processing. For example, Datacrown is a subsidiary of Crown Life Insurance Co., Canada Systems Group is jointly owned by T.Eaton Co. of Canada, Steel Co. of Canada and Gulf Oil Can. Computel is owned by Royal Trust. The parent companies thus obtain reliable service at very economic rates while the subsidiaries have an assured revenue base upon which to build. This means that they can provide very stiff competition to smaller independent firms.

There is some concern about regulated industries forming computer service subsidiaries. An example is Maritime Computer Ltd. which is wholly owned by Maritime Telephone & Telegraph.

Competing firms believe that such subsidiaries are in a position to take advantage of their position through favourable capital acquisition and transfer pricing arrangements. However, no published facts were found in my literature search to support this concern.

Two strategic implications of these trends are:

(a) any computer service industry firm that has widely held stock and is successful is a likely candidate for acquisition; and

(b) smaller firms should avoid head on confrontation with computer service industry giants by specializing in areas where they can provide special expertise.

Computer, Communications, Finance, Postal Industries Compete

Some economists expect an even greater shake-out as the computer, telecommunications, finance, and postal industries merge.[75] CNCP has complained that the regulated telephone companies are in a position to apply hidden subsidies to their competitive processing and communications offerings.[76] In the U.S., the Federal Communications Commission (FCC) has ruled that non-Bell common carriers must establish separate affiliates for the purpose of selling data processing services.[77] A Canadian example of this approach is Maritime Computers, the previously mentioned wholly-owned subsidiary of MT&T. On the other side of the coin, IBM has received FCC approval to offer a digital satellite service that encorporates

sufficient technological innovations to be highly competitive. Bell Canada has started manufacturing computer peripherals - it formed Bell Communications Systems Inc., Montreal, to sell terminals and switchboards to business customers.[78] Looking at the banking aspect, it seems only natural for banks to offer data processing services to their customers - payroll preparation, general accounting, financial analysis. A 1978 decision by the Manitoba Court of Queen's Bench indicated that the Toronto Dominion Bank exceeded its authority under the Bank Act by offering such services. However, either the appeal process or the revised Bank Act may yield a different eventual outcome.[79] Also, introduction of electronic funds transfer services will greatly expand banks' involvement in both the computer services and communications industries. The postal service now offers electronic mail services (TELEPOST) in direct competition with TransCanada Telephone System's Computer Communications Group service (ENVOY 100) and with that offered by two of Canada's largest service bureaus - Canada Systems Group (COMET: Computerized Message Transmission) and I.P.Sharp Associates (MAILBOX).[80] All of the above seems to suggest a future multi-faceted 'information industry' controlled by a few very large and very powerful companies.

## XI. Specialization

How are the smaller service bureaus to survive as this drama unfolds? There seems to be widespread agreement that

specialization is the optimum strategy. Arthur D. Little, a Massachusetts-based consulting firm, recently reported that, "Nine out of 10 firms that had a decrease in market share are either generalists (in terms of products and target markets) or have multiple specialties."[81] On the other hand many firms have increased market share by specializing in single industry market segments. Their competitive advantage comes from:

(a) their intimate knowledge of the chosen market segments, and the consequent learning curve efficiencies;

(b) their ability to develop and maintain application software specifically tailored to the needs of the target market; and

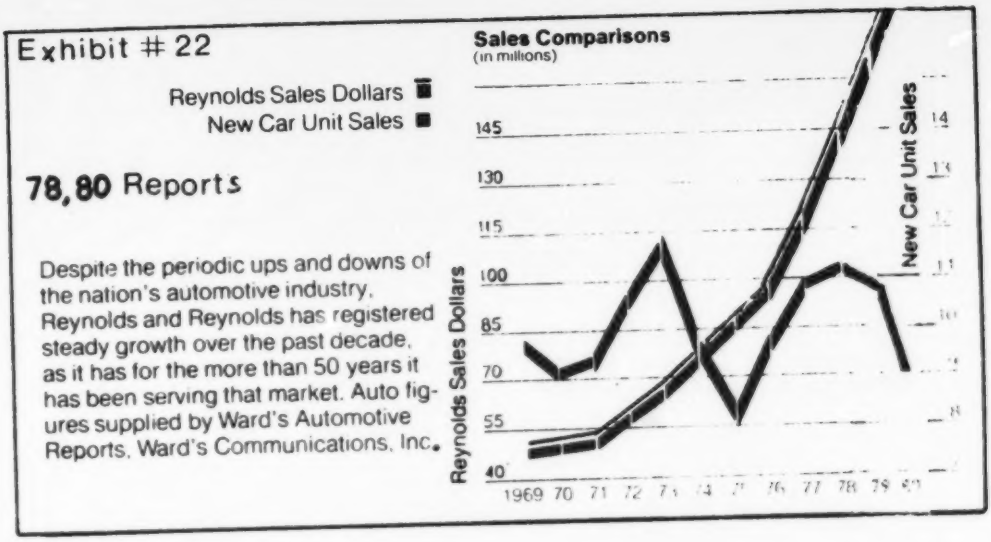
(c) the marketing value of reputation and contacts.

The vacation tour wholesaling, hospital, legal firm and auto industry markets are four examples where companies have succeeded in this manner.[82]

Of course, once the demand for services within a particular target segment starts to level off, a new market must be developed. This strategy has been followed by Reynolds and Reynolds which specialized in developing inventory systems for the auto industry. As shown in Exhibit #22 on the following page, the productivity increases generated by computer services resulted in increased sales each year. In anticipation of a leveling off of demand, Reynolds and Reynolds

is now entering the medical services field, offering inventory systems to hospitals.

Exhibit # 22


Reynolds Sales Dollars
New Car Unit Sales
78,80 Reports
Despite the periodic ups and downs of the nation's automotive industry, Reynolds and Reynolds has registered steady growth over the past decade, as it has for the more than 50 years it has been serving that market. Auto figures supplied by Ward's Automotive Reports, Ward's Communications, Inc.
Sales Comparisons
(in millions)
Reynolds Sales Dollars
New Car Unit Sales
145
130
115
100
85
70
55
40
14
1969 70 71 72 77 78 79

## XII. Conclusion

The Canadian computer services industry is young and dynamic. It faces turmoil as it accommodates a rate of growth of about 22% per year driven by hardware costs that are decreasing at the rate of 30% per year. Declining communication costs are expanding the boundaries of competition. Constantly changing processing trends both provide opportunities and pose threats to the service industry. The typical S-shaped EDP expenditure curve has accelerated revenue growth, with processing providing the greatest source of revenue. Amongst the many sources of software, there is ample opportunity for cottage industry scale companies to compete. However, all suppliers of software are faced with a severe shortage of programmers.

The gap between supply and demand is currently 5000 people and is growing annually. The larger service bureaus are overcoming this problem, achieving sustained growth through acquisitions and mergers. This is part of a larger process of rationalization that appears to be leading towards an information industry dominated by a few very large companies. In order to survive, the smaller service bureaus must specialize so as to increase the value added of the service they provide.

References

1. Editorial, Review/Forecast '81, Canadian Data Systems, December, 1980, p.57.

2. M. Irwin, S.C. Johnson, The Information Economy and Public Policy, Science, March, 1977, Data provided by M.U. Porat, Office of Telecommunications, U.S.A.

3. S. Kolodziej, New economic climate forces services evolution, Computer Data, January, 1980, p.29. (Growth was 28% in 1979 but dropped to 21% in 1980).

4. Same as (3).

5. Evans Research Corporation, based on government and industry data, published in The Financial Post Special Report, 24 January, 1981, p.52.

6. ACTUAL: Canadian Computer Census prepared by Canadian Information Processing Society
FORECAST: Evans Research Corporation

7. L.A. Shackleton, Latest census of computers shows new growth, Canadian Data Systems, May, 1980, p.97 (Annual computer census conducted by the Canadian Information Processing Society).

8. Evans Research Corporation, Guide to Small Business Computing, Appendix I-13.

9. Dr. H.S. Gellman, President, Gellman, Hayward & Partners Ltd., quoted in same article as (1), p.62.

10. Dr. J.C. Paradi, Canada's Computer Service Business Enters its Second Decade, Canadian Data Systems, February, 1980.

11. H.I. Apfelbaum, Trends in computer hardware technology, Canadian Data Systems, June 1980, p.39.

12. Same as (8), Vol. 2-I-19, December 1980.

13. R.J. Ball, VP and General Manager, Honeywell Information Systems, quoted in same article as (1), p.58.

14. B.A. Beneteau, President Northern Telecom Canada Ltd., quoted in same article as (1), p.52.

15. Brochure, Datapac Overview, published by the Computer Communications Group, 1980, pp.2 to 5 inclusive.

16. S. O'Connor, User demands create new opportunities in processing, Computer Data, February, 1980, p.23.

References, page 2

17. S. Naisby, Satellite Services in Canada, published in Discourse '78 by the Computer Communications Group, p.21.

18. Same as 15 , p.4.

19. Same as 15 , p.6.

20. D.R. Durnford, Network Design: More than Just Technology, published in same book as 17 , p.21.

21. S.B. Erskine, New Data Communications Service for U.S. Access to Canadian Users, same book as 17 , p.27.

22. C.I. Gibbon, Data Communication Networks, published in same book as 17, p.39.

23. Condensed from the explanation given in Datapac Overview, (Ref. 15), pp.8 to 10 inclusive.

24. B.I. Edelson, L. Pollack, Satellite Communications, Science, March 1977, p.1125.

25. Editorial, Satellites will meet user's needs, Computer Data, March 1980, p.38.

26. Organization for Economic Co-operation and Development, OECO, Information Studies, No. 3, Computers and Telecommunications - economic, technical and organizational issues, 1973, pp.117,118.

27. Same as (8), Vol. 2-I-1, December 1980.

28. Same as (16). Also, All About Small Business Computers, Datapro 70, September 1977.

29. Same as (8), Vol. 2-I-2.

30. Same as (8), Vol. 2-I-5.

31. Same as (8), Vol. 2-I-6.

32. Same as (8), Vol. 2-I-7.

33. R.L. Nolan, Managing the Crisis in Data Processing, Harvard Business Review, March-April, 1979, pp.115-126.

34. H. Brune, editor, Information Processing in Canada 1980 - 1985, published by Information Institute of Canada, Ottawa, January 1978.

35. Same as 28.

References, page 3

36. K. Kennedy, No Recession for Computers, The Financial Post Special Report, 1 Nov.'80, p.S9.

37. Prof. B. MacLean, based on newspaper report in Chronicle Herald, mid March 1981.

38. Editorial, Industry feels transborder data flow non-issue, Computer Data, January 1980, p.33.

39. Same as 38.

40. Francis Fox, published in same article as 1 , p.63.

41. J.W. Lipsett, General Manager, Prime Computer of Canada, quoted in same article as (1).

42. N. Gordner, 1981 Expenditure Forecast Survey, Computer Data, December 1980, p.38.

43. W.H. Peters, Alternatives to building your own application software, Canadian Data Systems, July 1980, p.73

44. Editorial, Programmerless computer seen answer to skills shortage, Info Systems, January 1981, p.23

45. B.J. Bleackley, Software, Computer Data, March 1980, p.29

46. S. Kolodziej, The computer revolution and the chip, Computer Data, April 1980, p.36

47. D.J. Doyle, President Digital Equipment of Canada, quoted in same article as (1), p.67.

48. Same as 43 , p.73.

49. Same as (8), Vol. 2-G-38, Glossary.

50. Editorial, Software Info Review, Infosystems, July 1980, p.52

51. Same as (43), p.73.

52. S. MacFarlane, Home Computers: What's Happening? Canadian Data Systems, p.28.

53. Editorial, Canadian Computer Service Industry Survey, Canadian Data Systems, June 1980.

References, page 4

54. Same as (43), p.74.

55. Same as (43), p.75.

56. Same as (9).

57. Mr. Jin, Dept. Head Data Processing, Algonquin College, 1 September 1981.

58. Same as (13).

59. Same as (9), p.58.

60. R. Taylor, President of Datacrown Inc., EDP applications, personnel, Financial Post, 24 January 1981, p.53.

61. S. Kolodziej, Educators fight uphill battle to help fill industry openings, Computer Data, August 1980, p.44.

62. Same as (10).

63. Same as (61), p.48.

64. E. James, Software Talent in the '80s, Computer Data, August 1980, p.50.

65. Same as (61), p.49.

66. Same as (64), p.51.

67. N. Gordner, Lots of Jobs Available, but Nobody to Fill Them, Computer Data, August 1980, p.37.

68. L. Pettus, Cross Canada Salary Survey, Computer Data, August 1980. Data extracted from the 1980 Computer Salary Survey and Career Planning Guide, produced by Source EDP, a professional recruiting firm devoted to the computing field.

69. Pay Research Bureau data published in Careers and the Job Market, The Financial Post, Special Report, 4 October 1980, p.12. (A comprehensive tabulation of average salaries and per cent increases from 1979 is given in this reference.)

70. D. McCann, Technical Consultant, Atlantic Canada, Computel, interview 19 March 1981.

References, page 5

71. Editorial, Specialization the route to growth, Financial Post Special Report, 24 January 1981, p.S4.

72. Same as (10), p.39.

73. R.K. Nelson, Consolidation continues in remote services industry, Computer Data, January 1980, p.34.

74. I.D. MacLean, Senior Consulting Partner; Peat, Marwick and Partners, quoted in same article as (1), p.62.

75. A.L. Robinson, Impact of Electronics on Employment: Productivity and Displacement Effects, Science, p.1168.

76. J.G. Sutherland, President & CEO, CNCP Telecommunications, quoted in same article as (1), p.60.

77. B. J. Bleackley, Spending on electronic mail could increase 400 per cent, Computer Data, February 1980, p.31.

78. Editorial, Bell Canada subsidiary to sell terminals direct, Canadian Data Systems, November 1980.

79. Editorial, Manitoba Service Bureau will carry Bank - Services Fight to Supreme Court, Canadian Data Systems, January 1980, p.25.

80. Same as (77).

81. Same as (71).

82. Same as (43).

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13. ABSTRACT

The paper provides an overview of the computer service industry in Canada. It describes the cost and technology factors affecting its rate of growth. Revenue sources are identified. Processing trends and software sources are reviewed. The impact of a shortage of programmers is discussed. The pattern of company mergers and information industry rationalization is briefly described. The concluding point is that specialization is the key to survival.

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